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Previews of highlights of Annual Meeting at Chicago, April 5–8, suggestions for independent work in arithmetic, analysis of research in teaching of mathematics, 1957 and 1958, announcements of summer institutes for elementary-school personnel.

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Editorial comments

About the articles

E. W. HAMILTON, *Associate Editor*

The two lead articles in this issue, those by Rose and Rose and by Aileen Shine, deal with different aspects of the question, "What effects do intelligence and background experience have on success in arithmetic?" These articles should be of interest to both the teachers and the parents of children who are not succeeding in arithmetic.

Counseling with parents of children who have trouble in school can be a painful and sometimes unproductive activity. These hints from the reported research and the review of related literature should be helpful.

The notion that maternal overprotection may be positively related to lack of success in arithmetic has been around for some time. The report by Rose and Rose of a test of that notion on a relatively large group is interesting.

Although the interpretation of other people's findings is dangerous and often thankless, it seems necessary to point out that the splitting of any array of data into a sufficient number of levels will reduce correlations to near zero, just as the unwarranted combining of adjacent age or grade groups will produce a spuriously *high* correlation.

Whether we interpret this evidence as strengthening or weakening the contentions of Levy and Plank, the authors' speculations about the effect of baby talk, sibling position, and parental interest, education, and status make challenging reading. We will watch eagerly for the promised article, reporting research directed more particularly at these issues.

The question of what the arithmetic teacher should know is developed in the next article. Dutton reports information and attitudes of prospective teachers. Several weaknesses are explored, and implications may be drawn for improving the curricular offerings for such students. The reaction of practicing teachers to several means used to upgrade their knowledge of some of the topics is the content of the report by Houston, Boyd, and DeVault. People who have the responsibilities for setting up in-service training programs can profit by these tips on methods of presentation and preferences of new versus experienced teachers as to programs they find most helpful.

The preference of teachers for some passive form of participation—being talked to—will surprise no one who has appeared before such groups. The question of whether this produces any result remains largely unanswered. In the case reported from Texas, any and all methods resulted in considerable use of material in classrooms. An attempt to compare the effects of passive versus active participation in some in-service program would be of considerable interest.

The articles by Parsons and Ashlock deal with the "whys" and "hows" of conveying certain concepts to children. For the inexperienced teachers, these accounts may provide models and suggestions for developing their own approaches, and for us who are experienced, these are a reminder to check ourselves occasionally to see that we are doing as well as we know how and that we aren't going stale or becoming cynical.

Intelligence, sibling position, and sociocultural background as factors in arithmetic performance

ALVIN W. ROSE AND HELEN CURETON ROSE
Wayne State University, Detroit, Michigan
Dr. Rose is associate professor of sociology at Wayne, teaching courses in social psychology. Mrs. Rose is a graduate student in the College of Education.

The significance of intelligence, as expressed in the I.Q., in predetermining success or failure in arithmetic apparently is still a question that is very much open. Hildreth, for instance, reports that while the I.Q. score seems to be a rather reliable basis for predicting performance in such areas as reading and spelling, there is not a similar relationship between intelligence and arithmetic.[1] Instead, for Hildreth, there are socioemotional or "personality" factors which are probably crucial in the success or failure of elementary children in arithmetic.

One of the more careful and methodologically rigorous recent studies of this question of the relationship of intelligence to the performance of the elementary school child in arithmetic was done by Leland Erickson.[2] From his study of 230 sixth-grade pupils drawn from eight classrooms of four schools, Mr. Erickson found that for the total sample of 230 children there was a correlation of .72 between I.Q. scores and arithmetic performance. However, when one related the I.Q.'s to arithmetic scores on the basis of subgroupings of arithmetic achievers, there was a significantly lower association. It may be seen in Table 1 that while the correlation between I.Q. and arithmetic scores for the total sample was .72, there were much lower, almost nonsignificant, scores for the subsamples grouped on the basis of arithmetic achievement. These latter scores, one may see from Table 1, were .39, .46, and .40 for the upper 27%, middle 46%, and the lower 27% of the sample, respectively.

One of the purposes of this article is to report the results of an inquiry into the relationship of intelligence to arithmetic performance for a sample of 456 third-grade children.

Another suspected factor in the success or failure of children in arithmetic is the socioeconomic background of the children. Erickson, in the same study, was also interested in this question. Briefly stated, he found that the frequency of higher I.Q.'s was significantly greater in the

Table 1

Relationship between intelligence and general arithmetic achievement

Group in arithmetic	*Number of pupils*	*I.Q. rating*	*Correlations of intelligence and arithmetic score*
Entire sample	230	54–137	.72
Upper 27%	63	84–137	.39
Middle 46%	104	75–130	.46
Lower 27%	63	54–113	.40

[1] Gertrude Hildreth, *Learning the Three R's* (Minneapolis: Educational Publishers, Inc., 1936), p. 814. See also Emma N. Plank, "Observations on Attitudes of Young Children Toward Mathematics," *The Mathematics Teacher*, XLIII (1950), 252–63.

[2] Leland H. Erickson, "Certain Ability Factors and Their Effect on Arithmetic Achievement," THE ARITHMETIC TEACHER V (1958), 287-93.

Table 2
Comparison of arithmetic achievement with frequency of occurrence in I.Q. levels between pupils in high and low socioeconomic groups

I.Q. range	*Number of pupils*		*Per cent of pupils above arithmetic test median*	
	High economic status	*Low economic status*	*High*	*Low*
Below 90	6	51	16%	3%
90–110	44	53	34%	36%
Above 110	65	28	83%	82%

higher socioeconomic levels; but when one equated arithmetic performance according to similar I.Q. ranges, there was no significant difference in arithmetic performance between the higher and lower socioeconomic groups.[3] Erickson concludes from Table 2 that, since 82% of lower socioeconomic students who had I.Q.'s above 110 scored above the median in arithmetic while 83% of the high socioeconomic group scored above the median in arithmetic, there is no significant influence which socioeconomic level membership may have on arithmetic performance.

Erickson's conclusion from his data seems open to serious question on at least two counts. In the first place his conclusion is drawn from an exceedingly small sample of twenty-eight students. While the fact that twenty-three of twenty-eight students making the expected high score is not likely to be a chance occurrence, a much larger sample may lead one to a different conclusion.

In the second place, Erickson is silent about the "Below 90" groups in Table 2. It may be seen from Table 2 that while only 3% of the low economic status group scored in arithmetic above the median, 16% of the high economic status group with "Below 90" I.Q.'s scored above the median in arithmetic. Now, one would have the same reservation about drawing conclusions, in this instance, because of the small sample. But, since Erickson did come to the conclusion with a small (though not as small) sample of the "Above 110" I.Q. group, it would seem that the sample size of the "Below 90" group is not that much smaller as to permit ignoring (within Erickson's frame of reference).

In this study, the question of the significance of socioeconomic background for success or failure in arithmetic has been reformulated and studied in what are thought to be somewhat more operational terms. Following the theory derived from small group studies that were stimulated by Professor Bales,[4] we hypothesized that the homogeneity in social and cultural background of the children is directly related to their success in arithmetic. Because third-grade children in an "upper-upper" suburban school are more or less socioculturally homogeneous, for instance, relatively little of the time and effort of these children will be invested in the socioemotional area of their interactions, leaving most of their allotted time free for concentration on the task area of arithmetic achievement. The same proposition would hold for a "lower-lower" or any other socioeconomic level, so long as the cultural orientation of the students is homogeneous. On the other hand, we reasoned that children whose backgrounds are heterogeneous tend perforce to become more involved in socioemotional interactional nuances, and correspondingly less

[3] *Ibid.*, p. 290.

[4] Robert Bales, *Interaction Process Analysis* (Cambridge: Addison-Wesley Press, 1951), Chaps. 1 and 2. A more recent experimental analysis of the interrelations of socioeconomic climate and ego or personality variables as they in turn are related to perceptions of task performance was done by Exline. See Ralph V. Exline, "Group Climate as a Factor in the Relevance and Accuracy of Social Perception," *Journal of Abnormal and Social Psychology*, LV (1957), 382–88.

uncorrupted effort can be given the task area of arithmetic achievement. The second objective of this study, therefore, was to explore the possible significance of socioeconomic background for success or failure in arithmetic via consideration of the relative cultural homogeneity factor which characterizes the classroom situation.

Before stating the third and final objective of this study it is necessary to refer to the literature on one other point. One of the emotional factors which has been suggested as significant in arithmetic failure is the overprotected child. Levy has drawn a clinical picture of the overprotected child as follows.[5]

> The mother lives only for her child. Her life is devoted to it. She is uncomfortable whenever she is away from it, if only for a few minutes. She allows the husband to have little or no share in her baby's training. It is her baby, not his. She threatens to leave the house if her husband dare lay a finger to the child. The husband's role as father is negligible and remains so throughout the life of the child. The mother's career becomes more and more exclusively maternal. Her sexual and social difficulties with the husband increase. They no longer go out together. The baby, later the child, becomes the everlasting excuse for the gradual elimination of the wifely role. Social life, previously active, becomes more and more restricted. When the child goes to school the mother accompanies him there, long past the time when the neighbors' children are on their way alone. She helps him with all his studies, allows him no friends for fear they will contaminate him, and is quite uncritical in her attitude toward him.

Dr. Levy has also listed some typical attitudes of the overprotecting mother toward the school teachers of her overprotected son or daughter:[6]

> *Case #8.* Mother feels boy is a genius and school authorities are against him. Frequently in school to protect him against supposed discrimination and to boost his marks.
>
> *Case #18.* Mother sends countless letters and notes remonstrating against school's abuse of patient. Believes schools are unappreciative of her son.
>
> *Case #13.* Mother thinks teachers are not sufficiently understanding of her son's nervousness. Always defends boy against school teachers.

[5] David M. Levy, *Maternal Over-Protection* (New York: Columbia University Press, 1943), p. 16.
[6] *Ibid.*, pp. 87–88.

It is the basic contention of Levy and a number of other studies that the overprotected child will not do as well in arithmetic as in other subjects, nor will he do as well in arithmetic as the child who is not overprotected.[7]

It is necessary to add here that in the more recent studies of the relationship of overprotection to arithmetic failure, the overprotected child is seen as more likely to be an only child or the youngest child. Emma Plank's study confirmed Levy's findings and pointed out that eleven of her thirteen retarded children were either the only child (five) or the youngest child (six).[8]

Now, it should be noticed that Levy's thesis of the relationship of arithmetic retardation to overprotection rests on twenty cases. Similarly Plank's confirmation of Levy's findings and her operational definition of the overprotected child as the only or youngest child rests on thirteen cases. An assumption of our study was that a statistical testing of the validity of these kinds of propositions which are based on such few cases is a necessary contribution. One may see from Table 3 (which is taken from Levy's study) that whereas the "pure" overprotected group was not retarded in reading, 37.5% of these overprotected children were retarded in arithmetic.

The threefold objective of this study, then, was to study the probable statistical association of (a) intelligence, (b) sociocultural homogeneity and (c) sibling posi-

Table 3
Reading-arithmetic retardation ratio

Type of student	*Retardation of one year or more*	
	Reading	*Arithmetic*
Overprotected (pure cases)	0.0	37.5
Overprotected (mixed)	5.6	22.2
Check group	23.8	29.8

[7] *Ibid.*, p. 96.
[8] Emma Plank, *op. cit.*, p. 254.

tion, as a possible index of overprotection, with the success and failure of third-grade children in arithmetic.

The study was designed to replicate that of Erickson, with the exception that third- rather than sixth-grade children were used. The Iowa Tests of Basic Skills and the Otis-Quick Scoring Mental Ability Test were the instruments employed. The data were secured from the records of 456 third-grade children. One hundred of these case records represent two third-grade classes of a public school in Bloomfield Hills, a high socioeconomic suburban area which is predominantly of business and professional, white, old family, upper-class composition. The faculty here is all white. The other 356 cases represent nine third-grade groups in a middle-class Detroit public school. The dominant feature of this area in Detroit is its cultural heterogeneity. It is "mixed" in terms of racial, ethnic, religious, occupational, and social identification. The faculty in this school is racially mixed.

For these two sociocultural groups the interrelations of arithmetic performance, intelligence, and sibling position were statistically examined.

Intelligence and arithmetic

By converting chi squares into correlation coefficients, the correlation of intelligence and arithmetic grades was .67 for the upper-class Bloomfield Hills sample of 100 cases and .53 for the 356 middle-class heterogeneous sample. The difference of .14 between these two correlations is barely significant at the level of five per cent. The inference, of course, is that the personality variable of intelligence tends to be more significantly related to arithmetic in a homogeneous group than in a heterogeneous group.

It should be remembered that Erickson's correlation for the same two variables with 230 children was .72. However, Erickson secured much smaller correlations when he subdivided his sample into high, middle, and low performers in arithmetic. The two samples in this study were similarly divided and the correlations with arithmetic scores calculated. Table 4 shows the results of these calculations as compared with the Erickson findings. These calculations show that when our sample is broken into the high and middle and low achievers, there also is a lower correlation of intelligence with arithmetic score. One can notice in Table 4 that with a sample of one hundred cases there were obtained smaller subdivision correlations than Erickson's with 230 cases, but with a sample of 356 cases, correlations slightly larger than Erickson's were obtained. One should not assume these lower subsample correlations to be nonsignificant, particularly when one considers their skewed character. However, they do show a significance which is less than that of the total sample, indicating that factors other than intelligence are operative.

It would seem, then, that Erickson's judgment of the matter may be substantial: "There are so many factors of acquiring arithmetic concepts. . . . The factors of ability, attitude, interest, aptitude, previous experiences, reading ability and other

Table 4
Relationship of intelligence and arithmetic performance, a comparison of Erickson and Rose findings

Group in arithmetic	*No. pupils*	*I.Q. range*	*Correlation*
Erickson			
Entire sample	230	54–137	.72
Upper 27%	63	84–137	.39
Middle 46%	104	75–130	.46
Lower 27%	63	54–113	.40
Rose			
Upper-class sample	100	81–139	.67
Upper 20%	20	102–136	.27
Middle 53%	53	89–139	.38
Lower 27%	26	81–124	.32
Middle-class sample	356	57–136	.53
Upper 12%	42	70–136	.43
Middle 63%	225	63–135	.50
Lower 25%	89	57–130	.48

Table 5
Relationship of overprotection to arithmetic performance

Upper-class sample (100)

Sibling position	*Grades* Excellent A	Good B	Average C	Poor D or E	*Totals*
Overprotection (either youngest or only child)	4	7	12	11	34
Neither only or youngest child	18	15	18	15	66
Totals	22	22	30	26	100

Middle-class sample (356)

Sibling position					
Overprotection (either youngest or only child)	17	19	28	23	87
Neither youngest or only child	30	96	79	64	269
Totals	47	115	107	87	356

factors all enter into the total picture of arithmetic achievement."[9]

Sibling position and performance in arithmetic

Following Plank,[10] the only and the youngest children in each of the two samples were grouped as those more likely to be overprotected. In the sample of 100, there were 34 such overprotected children; in the sample of 356, there were 87 overprotected. Table 5 shows the relationship of overprotected children to arithmetic scores.

The correlations between overprotection and arithmetic performance was .45 for the upper-class homogeneous group and .15 for the middle-class heterogeneous group. This does not seem to demonstrate a significant association between overprotection and performance in arithmetic. Tentatively, therefore, there is still a question as to the generalized validity or applicability of Plank's clinical findings on this point.

However, it should be noted here that 11, or 33%, of the overprotected children in the upper-class sample did poorly in arithmetic while 15, or only 23%, of the other children in that sample did poorly in arithmetic. A standard error test of this difference of 10% indicates a significance in this difference at the five per cent level. And, in the same manner, it should be noticed that whereas only 11, or 33%, of the overprotected children in the upper-class group did "good" or excellent in arithmetic, 33, or 50%, of the others did "good" or excellent in arithmetic. This 17% difference also yields a standard error that indicates the operation of factors other than chance.

In the heterogeneous middle-class group 23, or 26%, of the overprotected children did poorly in arithmetic, and 64, or 24%, of the nonoverprotected did poorly. This percentage difference of 2% can, of course, be attributed to chance. Similarly the 36, or 41.5%, overprotected who did well (A's and B's) and the 126, or 47%, nonoverprotected who did well give a 5.5% difference between these two categories that is nonsignificant.

It seems reasonable to suggest, therefore, that while the Levy-Plank hypothesis of overprotection (to the extent of definition in terms of sibling position) is not supported in either of these two samples, the personality variable of overprotection is more likely to come through, or become operative, in the homogeneous classroom situation than in the heterogeneous structure of the mixed neighborhood.

[9] Erickson, *op. cit.*, p. 289.
[10] Emma Plank, *op. cit.*, p. 255.

Discussion: The multiple prototaxic impact

On this point we should now report that a simple check on the parental occupational background of the upper-class overprotected children in this sample suggested an intervening explanatory variable which tends to be corroborated in sociopsychological theory. The variable is language. It is to this problem of language that Professor Hickerson has given some attention.[11] It is this factor of language experience which, it seems to us, the concept of overprotection partially may involve.

The distinguished psychiatrist, Harry Stack Sullivan, has the following to say about language experience:[12]

> There are, according to Sullivan, three modes of types of experience: the prototaxic, parataxic, and syntaxic. These terms refer to the manner in which experience is registered and to the nature and degree of inner elaboration which it is accorded. In the prototaxic mode there is an absolute minimum of inner elaboration, and experience consists mainly of discrete series of momentary states which can neither be recalled nor discussed. The syntaxic mode, in contrast, involves a maximum of inner organization and elaboration, and because it is fully encompassed by symbolic formulation and is logically ordered it can be discussed and completely communicated to others. The parataxic mode of experience lies between the other two. In it, experience is partially organized or organized in a quasi-logical manner, but there are also elements of which the individual is unaware. Parataxic experience can be discussed by the adult human subject, but Sullivan states: The mode which is easiest to discuss is relatively uncommon . . . experience in the syntaxic mode; the one about which something can be known, but which is somewhat harder to discuss, is experience in the parataxic mode; and the one which is ordinarily incapable of any discussion is experience in the prototaxic or primitive mode.

Now, it may be that the youngest child is more likely to be bombarded with "baby talk" by more people and for a longer period than any of the other children. The same may be true for an only child. This baby talk is what Sullivan is calling the "prototaxic mode or style of language," and since the youngest or only child may get more of it than the other children simply because there are more in the family to talk with him in this way, we have called it the "multiple prototaxic impact." It is not a language which is explicit and denotative, but one that is implicit and connotative. But it is the precise and specific and clear-cut language which is necessary for arithmetic comprehension. For instance, if this is correct it may well be that children of well-educated parents who are professionally trained in music or painting or literature or any of the other forms of art may do poorly in arithmetic because of the prototaxic language which characterizes these areas.

Of the 26 upper-class children who did poorly in arithmetic in this study, our check indicates that the mothers of 17 of these children have specialized graduate training in the fine arts of music, sculpture, and painting, and in liberal arts, psychoanalysis, religion, and philosophy.

It seems to us that this matter of language style to which the child is attuned may make the difference. Sax and Ottina have demonstrated that a sound training in syntaxic language will permit a child who has had no arithmetic before he reaches the seventh grade to do as well in seventh-grade arithmetic as the other seventh-grade children who have had arithmetic in the earlier grades.[13]

And, finally, the matter of language style seems to show up in cross-cultural comparisons of arithmetic performance. There is, of course, the view that the British child is more proficient in the "syntaxic" style of the English language about which Sullivan was writing. One of the significant comparisons of British and American children in arithmetic was done by Buswell.[14] Mr. Buswell concluded that: "It is clear that pupils at age eleven in English schools are markedly superior to

[11] J. Allen Hickerson, *Guiding Children's Arithmetic Experiences* (New York: Prentice-Hall, Inc., 1952).

[12] Anselm Strauss, *Social Psychology* (New York: The Dryden Press, 1952), p. 561.

[13] Gilbert Sax and John Ottina, "The Arithmetic Achievement of Pupils Differing in School Experience," *California Journal of Educational Research*, IX (January, 1958), 15–19.

[14] G. T. Buswell, "A Comparison of Achievement in Arithmetic in England and Central California," THE ARITHMETIC TEACHER, V (February, 1958), 1–9.

pupils of the same age in California in arithmetical achievement as measured by the 70-item test. In fact, their mean score on the test was more than double the California mean, 29.1 as compared with 12.1."

All this is to raise the possibility, then, that in studying the concept of overprotection and its relationship to success and failure in arithmetic, it may be that we have hit upon the more fundamental factor of language style as it develops in children according to their sibling position in the family and according to the kind of language that is spoken in different families, in different occupations and professions, in different socioeconomic categories, and in different cultures. We have not explored this factor systematically. It emerged in our thinking as a possible implication of all that we had set out to do. In a paper soon to follow, the results of a study designed to explore the significance of language style for arithmetic performance will be reported.

Summary

Reported in this paper were the results of an exploration into the interrelations of intelligence, sibling position, and sociocultural background with the success and failure of 456 third-grade children in arithmetic. The results were essentially fourfold. First, there was a significant relationship between intelligence, as expressed in the I.Q., and success or failure in arithmetic. However, when one selects the I.Q. scores according to subgroupings of arithmetic achievement, intelligence plays a less significant role, and the question of the operation of other factors is raised. This finding tends to support those of previous studies. Second, the analysis also indicated a greater significance between I.Q. and arithmetic performance when the children are involved in a homogeneous classroom situation than a learning situation that is socioculturally heterogeneous. Third, overprotection to the extent that it gets expressed in sibling position (as only or youngest child) is not significantly associated with success or failure in arithmetic. But it should be made clear that these data and the analysis may indicate no more than the probability that overprotection may not be translatable into sibling position. In this sense a serious question is raised as to any meaningful generalizability of the Levy-Plank hypothesis. However, the factor of sibling position is more significant in a homogeneous learning situation than in one that is socioculturally heterogeneous. Finally, the sociopsychological variable of language style—we have called it the multiple prototaxic impact—was suggested as one of the intervening explanatory variables in arithmetic performance, a variable whose significance needs examination.

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Relationship between arithmetic achievement and item performance on the Revised Stanford-Binet Scale[1]

AILEEN SHINE *Public Schools, Kansas City, Missouri*

As helping teacher in arithmetic for the primary grades in the public schools of Kansas City, Missouri, Dr. Shine's responsibilities include classroom observations and demonstrations, conducting in-service programs, and interpreting the arithmetic program for PTA groups.

Many studies have been made of the relationship between I.Q. and achievement in arithmetic. This study has sought to identify relationships between successful item performance on the *Revised Stanford-Binet Scale* and arithmetic achievement. The primary concern of this item analysis of the *Binet Scale* has been to determine if patterns of item response associated with high achievement in arithmetic could be identified.

The problem

For statistical purposes, the problem was stated in terms of the null hypothesis, i.e., that any relationship was due to chance. The hypothesis was applied to each level of the *Revised Stanford-Binet Scale* from Year IV-6 through Year VIII that there was no significant relationship between the passing of an item on the *Revised Stanford-Binet Scale* by kindergarten children and their achievement in arithmetic, as measured at fourth grade.

The sample

The sample was a stratified sample drawn from the pupil population in the 80 elementary schools of the Kansas City, Missouri, School District. The stratification was based upon the correlation between performance on the *Binet Scale* and socio-economic status, as established by Terman and Merrill.[2]

The following techniques were used to stratify the sample:

1. The 80 elementary schools in the school district were ranked according to percentage of I.Q. 120 and above. Official building reports were used as the base for computing per cent of membership.
2. The distribution was divided into quartiles. From each quartile, two schools were selected. In selecting the two schools from each quartile, the objective was to choose schools which were a representative or cross-section sample of the schools within the school district.

Every fourth-grade room in each of the eight schools selected was included in the sample. The total number of rooms was 21. The sample was limited to pupils who had entered the Kansas City Schools as kindergarteners and had remained in continuous attendance over this five-year period into the second half-year of the fourth grade. Of the 595 pupils enrolled in these rooms, 318 pupils met these delimitations of the sample.

[1] Aileen Shine, "Relationship Between Arithmetic Achievement and Item Performance on the Revised Stanford-Binet Scale" (Unpublished Ed.D. thesis, University of Colorado, 1960).

[2] Lewis M. Terman and Maud A. Merrill, *Measuring Intelligence—A Guide to the Administration of the New Revised Stanford-Binet Tests of Intelligence* (Boston: Houghton Mifflin Company, 1937), p. 48.

Procedure

A *Revised Stanford-Binet Scale*, Form L, was administered to each pupil during his kindergarten year by a trained psychological examiner. (It is a policy of the Kansas City Schools to administer a *Binet* to each kindergarten pupil.) Each pupil's performance on the *Scale*, item by item, was recorded on a pupil data sheet. The arithmetic achievement of these same pupils was measured in a four-week interval during the second half-year of fourth grade by the *Iowa Tests of Basic Skills: Arithmetic, Test A*.

Item performance on the *Revised Stanford-Binet Scale* was dichotomized in terms of pass or fail; arithmetic achievement scores were expressed as continuously distributed numerical values. The statistical technique used to define the relationship between these two variables was biserial correlation. Because the sampling error for biserial r is large when it is computed from proportions .95 or greater, coefficients of correlation were not computed for such extreme cuts. The standard errors of the biserial correlations were estimated for use in a Test of Significance of the null hypothesis at the 1 per cent level of confidence.

Conclusions

Table 1 presents the results of the item analysis of the *Revised Stanford-Binet Scale* from Year IV-6 through Year VIII. The following conclusions are based upon these data.

1. It was concluded that there was a definite, positive relationship between kindergarten pupils passing any item on the *Revised Stanford-Binet Scale* and their achievement in arithmetic, with the exception of Item 2, Year IV-6 and Item 2, Year V. These relationships or correlations were significant at, at least, the 1 per cent level of confidence.

Table 1
Biserial correlation of successful item performance on the Revised Stanford-Binet Scale and arithmetic achievement, according to mental functions measured

Mental function measured	*Name of item*	*Location*	r_{bi}	CR
Number concepts	Number concepts	VI, 4	.55	7.37
	Counting four objects	V, 6	.32	3.12
Vocabulary	Vocabulary	VIII, 1	.51	6.00
	Vocabulary	VI, 1	.35	3.89
Spatial relationships	Copying a square	V, 4	.41	3.98
	Copying a diamond	VII, 3	.40	4.63
Discriminative responses	Similarities-differences	VIII, 4	.49	4.09
	Similarities	VII, 2	.33	4.02
Controlled association	Opposite analogies	VII, 5	.41	5.22
Completion	Picture completion	V, 1	.42	3.52
	Mutilated pictures	VI, 3	.30	3.88
Comprehension	Comprehension IV	VIII, 5	.43	4.60
	Maze tracing	VI, 6	.35	4.47
	Materials	IV–6, 4	.35	3.41
	Comprehension	VII, 4	.27	3.63
Pictorial similarities, differences, absurdities	Pictorial likenesses and differences	VI, 5	.30	3.94
	Picture absurdities	VII, 1	.20	2.73
Memory	Memory for stories	VIII, 2	.42	4.69
	Memory for sentences	VIII, 6	.42	4.27
	Copying a bead chain	VI, 2	.32	4.00
	Memory for sentences	V, 5	.23	2.62
	Repeating five digits	VII, 6	.22	3.18
	Repeating four digits	IV–6, 2	.09	.81
Imitation of remembered movement	Paper folding: triangle	V, 2	.04	.40

2. There was no relationship between kindergarten pupils passing Item 2, Year IV-6 (Repeating 4 Digits) or Item 2, Year V (Paper Folding: Triangle) and achievement in arithmetic. No inferences were drawn concerning the possible achievement in arithmetic of pupils who pass or those who fail these particular items.
3. The item on the *Revised Stanford-Binet Scale* from Year IV-6 through Year VIII with the highest correlation with arithmetic achievement was Item 4, Year VI (Number Concepts). It was concluded that there was a strong degree of relationship between passing this item and achievement in arithmetic.
4. When the items were grouped according to type, such as number concepts, vocabulary, comprehension, and memory, it was readily concluded that all but one type of item (the copying test) correlated positively with arithmetic achievement.
5. The spatial relationship type of item which occurred at Year IV-6 (Item 4) with a biserial correlation of .41 and Year VII (Item 3) with a correlation index of .40 was the only type of item which had almost the same degree of correlation at different levels on the *Binet Scale* with achievement in arithmetic.
6. Other types of items occurring at different levels on the *Binet* varied in their degree of positive relationship with arithmetic achievement. Five of the six memory-type items correlated positively with arithmetic achievement; a sixth item (Item 2, Year IV-6, Repeating 4 Digits) had no correlation with arithmetic achievement.

Implications

No patterns of item response related to high arithmetic achievement were identified; the item analysis revealed rather that all items except two correlated positively with arithmetic achievement. The assumption that the total score of the *Binet*, expressed as MA or I.Q., is its most important contribution to educational guidance is substantiated.

The items of the *Revised Stanford-Binet Scale* represent a variety of mental functions of a highly verbal nature. It has been found that pupils who pass these items score higher in arithmetic than pupils who fail them. It may be inferred that facility in such mental activities contributes to success in arithmetic. It also seems reasonable to assume that effective readiness programs should include experiences similar to the types included in the *Binet Scale*.

A further implication of this study is the possible use of its results in establishing the reliability of the *1960 Revision of the Stanford-Binet Scale*.

Mathematics is the Science which uses easy words for hard ideas.
Kasner and Newman
in *Mathematics and the Imagination*

University students' comprehension of arithmetical concepts

WILBUR H. DUTTON *University of California, Los Angeles*

Dr. Dutton is associate director of the Training Department at the University of California at Los Angeles.

Teachers' understanding of basic arithmetical concepts is closely associated with the ability to present these concepts in classrooms. Numerous studies have been made to show the amount of understanding of arithmetic possessed by elementary-school teachers and students preparing to become teachers. Relatively little study has been made of changes made in students' understanding of arithmetical concepts as they progress through the courses designed to teach these processes. This study deals with measuring students' changes in understanding arithmetical concepts before and after completing a lower division mathematics course for elementary teachers.

The problem

This study is based upon three hypotheses:

1. Most college students have been taught arithmetic by elementary-school teachers who have stressed the computational aspects and drill procedures rather than the understanding of basic arithmetical concepts. This assumption is based upon the fact that changes in educational methods are not readily accepted by classroom teachers and do not affect pupil learning experiences for one or more decades [2].* These students attended elementary schools during the beginning of the movement to teach arithmetic meaningfully.
2. Students will be ambivalent in their feelings toward arithmetic and in their understandings of certain basic concepts. This hypothesis is based upon studies of student attitudes toward arithmetic [3] which show favorable and unfavorable feelings toward different aspects of arithmetical work. Also, in college classes dealing with the teaching of arithmetic, students may exhibit an understanding of some arithmetical concepts and at the same time be entirely ignorant of other equally important concepts.
3. While basic lower division mathematics courses for prospective elementary-school teachers provide students with a background of content for the teaching of arithmetic, these courses may not systematically provide for the understanding of important arithmetical concepts. Orleans [6, 7] and others support this assumption.

Procedure and subjects

The University of California Arithmetic Comprehension Test for sixth grade was given to 55 students enrolled in a lower division mathematics course for prospective elementary-school teachers at the University of California, Los Angeles. Students were tested at the beginning of the semester and at the close of the semester. The professors teaching the two sections did not have access to the tests used and did not attempt to alter teaching methods to cover arithmetical concepts measured by the tests.

* Numbers in brackets refer to the bibliography at the end of this article.

The arithmetic comprehension test used has a reliability of .89 and covers basic arithmetical concepts that elementary pupils are expected to know at the completion of sixth grade. Curricular validity was established by carefully studying the main textbooks used in sixth grade, by having experienced sixth-grade teachers evaluate test items, and by inviting a panel of mathematics professors to make suggestions for improving test items.

Attitudes of these university students toward arithmetic were measured by using the University of California Arithmetic Attitude Scale 3, Form C.

Findings

Results of this study will be reported under the following headings: (1) analysis of student performance on the arithmetic comprehension tests, (2) attitude of students toward arithmetic, and (3) changes made in student understanding of arithmetical concepts during the semester.

Analysis of student comprehension of arithmetic

Students enrolled in the elementary teacher education program at the University of California have completed the university entrance requirements which include a B-plus average, two years of a foreign language, and appropriate courses in mathematics and science. Most students have had one or more years of high school algebra and geometry. A few have had trigonometry and analytical geometry. They are required to take two courses in mathematics for teachers—the lower division Math. 38 and an upper division course in the teaching of arithmetic. Thus when the first arithmetic comprehension test (U.C.C.T.) was given, they had not had any courses dealing with arithmetic since leaving junior high school.

In Table 1, student *incorrect* answers are shown for tests 1 and 2. The net improvement is shown in the last column. Test items causing the largest number of errors were: (8) identification of partial product; (9) meaning of a remainder in long division; (10) multiplication terms; (13) using standard time zones; (14) moving the decimal point in division; (15) placement of quotient figures in long division; (22) drawing a picture of $3 \div 1\frac{1}{2}$; (23) reading fractional part of a rectangle; (29) drawing a picture of $2\frac{1}{2} \div \frac{1}{2}$; (30, 31) using ton and gross; (36) using volume; (37, 38) adding and multiplying with decimals and placement of the decimal point in the answer; (39) meaning of a ream; (45) regrouping with denominate numbers.

Note that after students had completed the mathematics course (column 2) significant improvement had been made for nearly all test items. There were, however, six test items which continued to cause serious difficulty for students: (1) What does a remainder mean in long division? (2) placement of quotient figures in long division (3) placement of the decimal point in addition; (4) placement of the decimal point in multiplication of decimals; (5) meaning of gross and ream; (6) regrouping with denominate numerals.

A misconception in problem 9

$$\left(\text{What does the remainder mean? } \begin{array}{r} 5 \\ 4\overline{)22} \\ \underline{20} \\ 2 \end{array}\right)$$

was to blindly state that this meant two-fourths rather than two of the 22 units left over after subtracting 4 from 22 five times. Students had been taught *always* to place the remainder in the quotient as a fraction regardless of the way the problem was written.

Placement of the quotient figures in long division had been taught as a mechanical process in elementary-school grades. Students did not understand the use of place value applied to the writing of quotient figures.

The meaningful placement of the decimal point in addition and multiplication problems caused students considerable difficulty. Most students kept the decimal point in a straight line while adding and

Table 1
Number of students choosing incorrect answers on U.C.C.T. (tests 1 and 2) and net improvement

Test item	*Description of test item*	*Wrong 1 1st test*	*Wrong 2 2nd test*	*Net improvement*
1	Number of hundreds in 160	5	3	2
2	Locating thousands' place	0	4	−4
3	Rounding off	11	4	7
4	Carrying in addition	6	2	4
5	Subtracting with regrouping	2	0	2
6	Understanding large numbers	6	2	4
7	Liquid measures	15	6	9
8	Using partial products in multiplication	37	19	18
9	What does a remainder mean? Division	46	32	14
10	Multiplication terms	21	13	8
11	Subtracting with decimal fraction	3	2	1
12	Place value (10,000)	2	4	−2
13	Using time zones	27	14	13
14	Moving the decimal in division	22	1	21
15	Placement of quotient figures	43	25	18
16	Locating hundredths' place	6	3	3
17	Number less than 2.02	6	4	2
18	Number larger than 2.04	1	1	0
19	Base of our number system	0	0	0
20	Reading decimal fractions	6	3	3
21	$\frac{1}{2}\times 8$ (show)	3	3	0
22	$3\div 1$ (diagram)	36	16	10
23	One-third used in rectangles	29	9	20
24	Part of rectangle (Decimal fraction)	4	2	2
25	Perimeter	10	4	6
26	Uses of zero	15	10	5
27	Proportion of a number	3	3	0
28	Reducing a fraction	2	0	2
29	$2\frac{1}{2}\div\frac{1}{2}$ (diagram)	39	4	35
30	Pounds in a ton	21	1	20
31	Use of "gross"	20	14	6
32	Reducing fractions	15	11	4
33	Square measure	6	6	0
34	Size of decimals (.001)	10	1	9
35	Meaning of ¢.10$\frac{1}{2}$	5	2	3
36	Volume	20	11	9
37	Addition with decimals	29	27	2
38	Multiplication with decimals	37	32	5
39	Use of "ream"	47	35	12
40	$2\times 1\frac{1}{2}$	1	1	0
41	$\frac{5}{8}\div\frac{1}{8}$	10	6	4
42	Use of per cent (100%)	2	1	1
43	Applying decimal fractions	8	1	7
44	$\frac{1}{2}\times\frac{1}{2}$	5	1	4
45	Regrouping with denominate numbers	23	23	0
46	Area in measurement	10	5	5

counted the number of decimal places in multiplier and multiplicand to point off the answer in multiplication with decimals. This was especially noticeable since moving the decimal point in the divisor and dividend in long division with decimal fractions was understood by these same students at the close of the semester.

Students were not aware of common measures—gross and ream. The common practice of purchasing paper by a quire or ream, without questioning the number of sheets involved in each, may be typical of our culture. Similar difficulties were encountered when working problems involving an understanding of gross.

Table 2
Scale for measurement of attitudes toward arithmetic and scores of 55 university students

Item number	*Scale items*	*Value of items*	*Student choices of scale items*
1	I feel arithmetic is an important part of school curriculum.	7.2	44
2	Arithmetic is something you have to do even though it is not enjoyable.	3.3	13
3	Working with numbers is fun.	8.7	27
4	I have never liked arithmetic.	1.5	6
5	Arithmetic thrills me and I like it better than any other subject.	10.5	4
6	I get no satisfaction from studying arithmetic.	2.6	2
7	I like arithmetic because the procedures are logical.	7.9	21
8	I am afraid of doing word problems.	2.0	21
9	I like working all types of arithmetic problems.	9.6	12
10	I detest arithmetic and avoid using it at all times.	1.0	0
11	I have a growing appreciation of arithmetic through understanding its values, applications and processes.	8.2	33
12	I am completely indifferent to arithmetic.	5.2	3
13	I have always liked arithmetic because it has presented me with a challenge.	9.5	14
14	I like arithmetic but I like other subjects just as well.	5.6	27
15	The completion and proof of accuracy in arithmetic gave me satisfaction and feelings of accomplishment.	9.0	30

Regrouping to subtract with denominate numbers represented an area probably not used since students were enrolled in junior high school. Obviously, this area was not covered in the university course.

Attitude of students toward arithmetic

The University of California Arithmetic Attitude Scale 3, Form C, [3] was used to measure student attitudes. The scale with the value of each item is shown in Table 2. Note that the highest scale value is 10.5 (like) and the lowest is 1.0 (dislike).

Note that 44 out of the 55 students tested felt that arithmetic was an important elementary school subject. Students also indicated a growing appreciation of arithmetic through understanding of its values and applications. Another sizeable group, 27 out of 55, enjoyed working with numbers. Expressions of dislike for arithmetic centered around fear of word problems, general dislike for the subject, and a preference for subjects other than arithmetic.

By making a total of the scale values for all items selected by students, an average score for the attitude test was obtained—Table 3. Approximately one-third of the students in this sample have negative attitudes toward arithmetic. The median score is 6.5. These scores compare favorably with those of university students taking a course in the teaching of arithmetic just prior to student teaching.

Table 3
Average attitude score for 55 university students

Scale values	*Student scores*
8.5	5
8.0	10
7.5	5
7.0	8
6.5	8
6.0	3
5.5	3
5.0	4
4.5	3
4.0	4
3.5	0
3.0	1
2.5	0
2.0	1
1.5	0

$N = 55$

Changes made in students' understanding of arithmetical concepts during one semester

Two matched samples were used in this study, with two distributions of scores—test one at the beginning of the study and test two at the close. The means for these tests were: $M_1 = 33.94$ and $M_2 = 38.78$. To determine whether the difference between the M's was significant, the direct-difference method was used. [8]

$$\sigma_{MD} = \frac{\sigma_D}{\sqrt{N-1}} =$$

$$\sigma_{MD} = \frac{2.36}{\sqrt{54}} = \frac{2.36}{7.35}$$

$$\sigma_{MD} = .32$$

$$t = \frac{4.83}{.32} = 15.41$$

In an experiment using matched groups the number of degrees of freedom for evaluating t is $N-1$. The t for this study is significant at the 1% level.

Conclusions

Prospective elementary school teachers in this study adhered to many arithmetical concepts and procedures learned in elementary and junior high school. Contrary to studies made by Orleans and others, there are many basic arithmetical concepts that are understood by prospective teachers. In this study, students still clung to traditional methods when they attempted to explain partial products in multiplication, placement of quotient figures in long division, and placement of the decimal point in the answers to problems involving decimal fractions. The understanding of denominate numerals seems closely associated with the lack of emphasis placed upon these processes in our mechanized and industrialized society.

The attitudes of students toward arithmetic reflect a growing appreciation of the subject as they increase their understanding of its values and applications. Expressions of dislike for arithmetic, given by one-third of the students in this sample, center around fear of word problems, drill, and general dislike for the subject. Many students have ambivalent feelings toward arithmetic—they like some aspects very much and are cynical about other phases.

This study revealed the large amount of student progress made in one semester in a lower division mathematics course in understanding arithmetical concepts required for mastery of sixth-grade arithmetic. No attempt was made to measure other outcomes, especially the development of skill in computation. While the background of content for teaching of arithmetic and the understanding of basic concepts were increased significantly, a systematic approach to eradicate student misunderstandings of arithmetical concepts should be provided. It is the firm conviction of the writer that future gains in the education of prospective teachers of arithmetic must be based upon adequate analysis of student misconceptions and systematic efforts to assist each student to build new concepts based upon his present knowledge.

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An in-service mathematics education program for intermediate grade teachers

W. ROBERT HOUSTON *University of Texas, Austin, Texas*
CLAUDE C. BOYD *University of Texas, Austin, Texas*
M. VERE DeVAULT *University of Texas, Austin, Texas*

Mr. Boyd, former elementary principal at Austin, Texas, is currently serving as lecturer in the Division of Extension Teaching at the University of Texas. Mr. Houston, formerly principal at Midland, Texas, is serving as consultant in Elementary Education in the In-Service Education Project at the University of Texas. Dr. DeVault is associate professor of Curriculum and Instruction at the University of Texas.

The extensive concern for promoting the continued education of teachers beyond the four-year college program promises to place increasingly greater demands on in-service education. Although many schools are engaged in in-service education of one kind or another, few schools have reported attempts to evaluate the effectiveness of these programs. Research in the effectiveness of various kinds of in-service programs is needed if efforts to improve understandings of teachers are to be efficient and effective in the improvement of educational opportunities for boys and girls. This is a report of the evaluation of an in-service program which utilized a team-teaching approach and the use of television, lectures, question discussions, and written materials.

During the spring of 1960, a series of five weekly one-and-one-half-hour sessions was planned and presented co-operatively by a teaching team representing several departments of the University of Texas in co-operation with the Austin Public Schools. Five aspects of arithmetic now receiving increased attention as a part of modern mathematics were the focal points of the series. Instruction in both content and methods of teaching was provided. The topics of the five programs were (1) number and numeral, (2) base and place, (3) structure of the number system and its relation to the four fundamental operations, (4) some laws of arithmetic, and (5) a model theory in mathematics. Presentation media included closed-circuit television, lectures, and question-discussion periods. In addition, written materials on all topics discussed in the series were furnished each participant.

The 252 Austin teachers participating in the series varied widely in experience and mathematics background. The following data relative to the characteristics of the group were obtained from a personal inventory completed and returned by 223 participants.

Forty-three per cent of the participants were primary-grade teachers and forty-three per cent were intermediate-grade teachers. Eight per cent taught in the junior high school and six per cent were special teachers or administrators. Seventy-five per cent of all participants had more than four years' teaching experience.

Ninety per cent of the participants indicated they had at least one college course either in mathematics or in the teaching of mathematics. Seventy-five per cent of the

Table 1
General reaction to the series

Response	*Number*	*Per cent*
One of the best I've ever attended	55	25
Generally good	116	52
Generally fair	43	19
Generally poor	7	03
One of the poorest I've ever attended	2	01
Total	223	100

participants had taken some work in college mathematics, and sixty-five per cent of the teachers had had one or more courses in the teaching of mathematics. Teachers who had taken more courses in college mathematics tended also to have taken more courses in the methods of teaching mathematics.[1]

In evaluating this in-service education series, the following specific problems were investigated:

1. How was length-of-teaching experience related to general reaction to the series?
2. How was length-of-teaching experience related to expressed usefulness of the series?
3. What were the teacher ratings of the relative effectiveness of various media used in the series?
4. How was length-of-teaching experience related to teacher ratings of the relative effectiveness of various media?

Results of the study

The vast majority of participants indicated that the series was of considerable value. Seventy-one per cent thought it was of some use. Only three per cent thought it was not a useful series. In reaction to the one-and-one-half-hour length of each session, ninety-seven per cent considered this to be about the right length for an evening in-service education session. Five sessions were considered about the right number by the vast majority of participants, although ten per cent thought more sessions would have been better. Teachers highly favored the team approach to in-service education.

The reactions of participants to the question, "What is your general reaction to the series?" are presented in Table 1. Virtually all reactions were good. Only nine teachers rated the series as poor.

Eighty per cent of those teachers who were currently teaching arithmetic classes reported having used some materials from the series in their classrooms. No attempt was made to elicit the frequency or extent of this classroom use. Twenty per cent of the participants stated that they had not, at the time of evaluation, used any materials from the series in their classroom. Several weeks after the conclusion of the

[1] A chi square analysis of data revealed a level of significance of this finding at greater than .01.

Table 2
Classroom use of materials

Response	*Number*	*Per cent*
Yes	165	74
No	43	19
I do not have an arithmetic class	11	05
No response to item	6	02
Total	223	100

series, written materials were being read, discussed, and used as references by teachers. A later response than that presented in Table 2 might have indicated that an even greater number of teachers had found classroom uses for the ideas which had been presented.

Teachers were asked to rank from 1 to 4 the various media used in the series, according to their effectiveness in conveying the ideas included in this in-service education series. Although lecture was ranked slightly higher than television, the differences were not significant. Question-discussion sessions were ranked third and written materials fourth. (Table 3)

Reactions of teachers to the series in general, to its usefulness in the classroom, and to each of the four media used were analyzed by length-of-teaching experience. Three out of four teachers had more than four years' teaching experience; one-fourth had less than four years' experience. The differences in responses of experienced and less experienced teachers were analyzed and the results presented in Table 4.

Table 3
Relative effectiveness of media

Media	*Mean rank*
Lecture	1.9
Closed-circuit television	2.1
Question-discussion	2.8
Written materials	3.1

Table 4
Analysis of reaction by experienced and inexperienced teachers

Teacher reaction	*Rating*	*Observed frequencies* Group I (1–3 yr.) ($N=45$)	*Observed frequencies* Group II (4 or more yr.) ($N=178$)	*Expected frequencies* Group I (1–3 yr.) ($N=45$)	*Expected frequencies* Group II (4 or more yr.) ($N=178$)	*Chi square*	*df*	*p*
General reaction to series	1	0	55	11.1	43.9			
	2	14	102	23.4	92.6			
	3	24	19	8.7	34.3	71.94	4	.01
	4	5	2	1.4	5.6			
	5	2	0	.4	1.6			
Classroom use of materials	Yes	33	132	34.9	9.1			
	No	11	32	130.1	33.9	.64	1	—
Relative effectiveness of television	1	20	56	15.1	60.9			
	2	7	65	14.3	57.7	8.12	3	.05
	3	12	33	8.9	36.1			
	4	5	24	5.7	23.3			
Relative effectiveness of lectures	1	12	90	20.3	81.7			
	2	13	37	10.0	40.0			
	3	16	37	10.6	42.4	8.83	3	.05
	4	3	13	3.1	12.9			
Relative effectiveness of question-discussion sessions	1	8	20	5.6	22.4			
	2	18	33	10.2	40.8			
	3	9	69	15.5	62.5	13.36	3	.01
	4	9	55	12.7	51.3			
Relative effectiveness of written materials	1	2	11	2.6	10.4			
	2	8	30	7.6	30.4			
	3	10	67	15.3	61.7	4.53	3	—
	4	24	69	18.5	74.5			

In stating their general reaction to the series, teachers with four or more years' teaching experience rated the series significantly higher than did those with less teaching experience. However, as Table 4 further indicates, no significant differences were found between the two groups in their use of materials in the classroom.

Lectures were ranked significantly higher by teachers with four or more years' teaching experience than by the less experienced teachers. On the other hand, teachers with less than four years' experience rated both television and question-discussion sessions significantly higher than did the more experienced teachers. Effectiveness of various media appears to be related to teaching experience, or perhaps age (not included as a part of this study), or a combination of the two.

Implications

The findings of this study would indicate that administrators should consider procedures for individualizing in-service education programs for teachers. Teachers have varying interests, capabilities, and goals. Just as a good teacher uses different teaching methods with different pupils, so a director of in-service education should tailor programs to the individual needs of teachers. There is some indication in the results of this study that these programs for beginning teachers should differ from those for teachers of more experience. They should be different in content, in methods of approach, and in the use of different media.

It should be pointed out that this report concerns work with a single group of teachers and that more extensive studies of in-service education programs and their effectiveness with various media and with varying groups of teachers are needed. Studies are needed which investigate the changes brought about in the classroom as a result of in-service education programs. Case studies, classroom observation, pupil interview techniques, and experimental studies involving pre- and post-testing of both teachers and pupils are but some of the techniques which should be utilized. Such studies must be forthcoming if continued extensive effort devoted to in-service education is to make the greatest possible contribution to the continued growth of teachers.

Will you contribute to a forthcoming yearbook?

The Board of Directors of the National Council of Teachers of Mathematics at the April 1960 meeting approved the preparation and publication of a yearbook to be devoted to the problem of the mathematical education of the talented student in grades K–12.

It is intended that the yearbook be a *sourcebook* of topics and materials which have been found useful in enriching the mathematics program of talented students, but which are not parts of either traditional or experimental courses.

Under the chairmanship of Julius H. Hlavaty, the editorial committee, some members of which are listed below, has accepted the responsibility of preparing the grade level sections as indicated here. If you have material which you believe would make a contribution to achieving the purpose of the yearbook, won't you send it to the appropriate member of the committee, or to the chairman? Please submit your contribution no later than February, 1961. Where grade levels as listed below overlap, send the material to either member, but not to both.

K–8—Vincent J. Glennon
Director, Arithmetic Center
Syracuse University
Syracuse 10, New York

7–10—Joseph L. Payne
3019 University School
University of Michigan
Ann Arbor, Michigan

9–11—Henry Syer
Kent School
Kent, Connecticut

12, Honors—Harry D. Ruderman
Hunter College High School
930 Lexington Avenue
New York 31, New York

Full credit will be given to each contributor whose material is used.

Julius H. Hlavaty, *Chairman*
Commission on Mathematics, CEEB
475 Riverside Drive
New York 27, New York

Unusual arithmetic

CYNTHIA PARSONS *Cos Cob, Connecticut*

Miss Parsons teaches fourth grade in the North Tarrytown Elementary School. She is also an algebra demonstration teacher for the Madison Project, Syracuse University.

The love of a game, the chance to work with a friend, and the joy of discovering or uncovering facts can be combined in one assignment. The following games are called Scavenger Hunts—a name taken from an adult game requiring much initiative and some skill.

Children in grades 3–8 have participated in these hunts with the greatest enthusiasm. In fact they cheerfully did more "work" than they had ever done before using this motivating device.

The hunt is given to the entire class. Often the slower student in arithmetic is the faster one in research. Also, he is quick to get a partner who will complement him, and the different teams within a class sometimes work out quite evenly.

The hunts are addressed to the children. Anyone using the following questions may wish to make some changes in the wording and mimeograph the questions suitable for his particular class. The figures in parentheses are the point-values for the questions. An asterisk beside a point-value indicates partial credit may be given at the teacher's discretion.

Scavenger Hunt 1

Good scavengers can find most of the information in approved encyclopedias and the *Information Please Almanac*. The following are some general rules for the hunt. Your teacher will provide others necessary for your needs.

1. No team may have less than 2 or more than 3 members.
2. No less than 4 or more than 7 days are allowed for the hunt. Everyone must begin and end his search at exactly the same time.
   Beginning time for this hunt: ________
   Ending time for this hunt: ________
3. Advice and information may be obtained from any source. All mental figuring or physical construction must be done essentially by the team members.
4. Only one answer per question is allowed for each team.
5. The winning team is that one whose members have scored the most points.
6. To earn points for an answer, a team's answer must satisfy *all* the conditions of the question.

Questions

(*1*) 1. How many square feet in a square mile? ________

(*1*) 2. How many kilometers in a statute mile? ________

(*1*) 3. According to the 1955 census, what is the density of population per square mile of Lichtenstein? ________

(*1*) 4. According to the 1956 census, what is the density of population per square mile of Monaco? ________

(*1*) 5. According to the 1956 census, what is the population per square mile of the kingdom of Saudi Arabia? ________

(*3*) 6. What is the monetary unit for each of the following countries:
   a) Spain? ________
   b) Sweden? ________
   c) Yemen? ________
   d) Liberia? ________
   e) Laos? ________
   f) Japan? ________

(*1*) 7. What is the height, in feet, of Mt. Popocatepetl? ________

(*1*) 8. What is the greatest known depth in the Pacific Ocean? ____

(*4*) 9. What is the name of a lake that has an area of 22,400 square miles? ______

(*2*) 10. In 1950, what was the longest ship canal in the world? ______ How long is it? ______

(*4*) 11. What are the dates of the Ming Dynasty? ______

(*5*) *12. Construct a candle-timer. Mark a candle into at least six 10-minute sections. As the candle burns, it should reach the next mark in exactly 10 minutes.

(*3*) 13. In what year was Westwood, Massachusetts, set off from Dedham, Massachusetts? ______

(*5*) 14. How many years elapsed between the issuing of the first U.S. postage stamp and Lindbergh's historic first flight across the Atlantic? ______

(*2*) 15. What is the difference between T. R. Cobb's highest batting average and T. S. William's highest batting average? ______

(*2*) 16. What is the approximate surface temperature of the sun? ______

(*5*) *17. Construct an hourglass (see Webster's dictionary) that runs for exactly 5 minutes.

(*2*) 18. How many feet higher than Mt. Whitney is Mt. McKinley? ____

(*2*) 19. What would be the batting average of a baseball player who had 22 hits out of 49 times at bat? ______

(*4*) 20. How much more area, in square miles, does the Republic of India have than Austria? ______

Scoring: It is possible to earn 50 points:
40 to 50 points is excellent
30 to 39 points is good
20 to 29 points is fair

Scavenger Hunt 1 *Answers*

1. 27,878,400 2. 1.6093 3. 243.6 4. 32,049.5 5. 9.8 6. Peseta, krona, riyal, U.S. dollar, Kip, yen 7. 17,883 8. 35,400 feet 9. Michigan 10. Suez, 100.6 miles 11. 1368–1644 A.D. 12. (Partial credit may be given at the discretion of the teacher.) 13. 1897 14. 80 (1847–1927) 15. 14 (420–406) 16. 11,000° F. 17. (Credit at the discretion of the teacher.) 18. 5,805 19. .449 20. 1,233,389 (1,265,763–32,374)

Scavenger Hunt 2

Remember to use good encyclopedias and that many times an answer may be found easily in the *Information Please Almanac.* Your teacher may give you additional rules, but in general the rules for Scavenger Hunt 1 apply.

Beginning time for this hunt: ________
Ending time for this hunt: ________

Questions

(*1*) 1. If it is 12 noon in Boston, Massachusetts, E.S.T., what time is it in Bangkok, Thailand? ______

(*5*) 2. What numerical figure does each letter stand for?

A B C D	A = ______
A B C D	B = ______
A B C D	C = ______
±A B C D	D = ______
E B E A	E = ______

(*4*) 3. Anne's birthday is 15 days before Bill's. Clara's birthday is 23 days before David's and 24 days after Bill's. David's birthday is in June. Anne's birthday is in March. What are the birth dates of each?
Anne ______ Bill ______ Clara ______ David ______

(*1*) 4. What are the missing numbers: 1_7_×8 = _58_4 ? ______ ×8 = ______

(*2*) 5. What was the population density per square mile of Egypt in 1955? ______

(*2*) 6. What is the average of the normal annual precipitation, as given in the *1959 World Almanac*, for the following cities: Atlanta,

Georgia, Eastport, Maine, St. Louis, Missouri, Block Island, Rhode Island, and San Juan, Puerto Rico? _______

(*1*) 7. What large lake is 12,507 feet above sea level? _______

(*2*) 8. What is the difference in statute miles between the length of a degree of latitude at the equator and at the poles? _______

(*1*) 9. If we carried Baht as money, we would be in what country? _______

(*5*) *10. Construct a line graph showing the growth in population of New York City in 1800, 1900, 1930, 1950 as compared with Philadelphias' population growth in same years.

(*10*) 11. What is the difference in area between the largest U.S. national monument and the one located at Scotts Bluff, divided by the area of the one at Yucca House? _______

(A lot of scavenging is necessary for this one, and so it earns ten times as many points as question 9.)

(*1*) 12. What per cent of U.S. Senators will be elected in 1961? _______

(*1*) 13. What is one-third of one-third of one-third? _______

(*2*) 14. What number is next in this progression: 6 $15\frac{1}{2}$ $34\frac{1}{2}$? _______

(*1*) 15. What was the population of Eureka, California, in 1950? _______

(*1*) 16. Twenty thousand leagues under the sea is how many miles under the sea? _______

(*3*) 17. How many years ago was the Cape-to-Cairo railroad completed? _______

(*2*) 18. If in a cave on Cape Cod you found a bar of gold which was 12″ long, 12″ wide, and 12″ high, how much would the bar of gold weigh? _______

(*2*) 19. Tungsten is a metal used in light bulbs because it will carry electricity without melting. Just how hot does tungsten have to get before it does melt? _______

(*1*) 20. How many gallons of petroleum are in 1 barrel? _______

(*5*) *21. Construct a working balance scale.

Scoring: It is possible to earn 53 points:
40 to 53 points is excellent
30 to 39 points is good
20 to 29 points is fair

Scavenger Hunt 2 Answers

1. 0.00 next day 2. A=2, B=3, C=4, D=8, E=9 3. March 31, April 15, May 9, June 1 4. 1978×8=15,824 5. 60.2 6. 44.07 2/5 7. Titicaca 8. .703 9. Thailand 10. (Approximately) New York City: 2,000,000–3,000,000–7,000,000–8,000,000 Philadelphia: 850,000—1,000,000–2,000-000–2,100,000 11. 269,541.9 12. None 13. 1/27 14. 72 1/2 15. 23,058 16. 60,000 17. 42 (1918) 18. 1,205 lb. 19. 3,380±20° C. 20. 42 21. (Points at discretion of teacher.)

Scavenger Hunt 3

How did you do on the other two Scavenger Hunts? If you really did a thorough job, then you know how to use reference books. A lot of the answers that you are asked to find may not be important to you. But what is very important is that you have learned where to find those answers. In this hunt, you can find several clues to answers in a good dictionary, as well as in authoritative encyclopedias and in accurate almanacs.

The same rules apply for this hunt as for Hunts 1 and 2.

Beginning time for this hunt: _________
Ending time for this hunt: _________

Questions

(*2*) 1. A boat traveling at 30 knots is going how many miles per hour? _______

(*2*) 2. If the Great Wall of China had been built in the United States

with its eastern end at Washington, D.C., where would its other end be, if it ran east and west? ______

(*1*) 3. What is the length of channel span for the longest bridge in the United States? ______

(*4*) 4. Use 4 threes and only 4 threes to get each of these numbers: 17, 28, 30, and 43.

(*10*) *5. Construct to scale a solar system containing our sun, our earth, our moon, and at least 5 other planets.

(*1*) 6. How many books are there in the Harleian Library? ______

(*1*) 7. What is the specified weight of a regulation golf ball? ______

(*2*) 8. How many years ago were nutria first imported to the United States? ______

(*1*) 9. What is the gross tonnage of the SS "United States"? ______

(*1*) 10. About how many people today speak the Munda language? ______

(*2*) 11. How many fewer blacksmith shops were there in the United States in 1948 than in 1939? ______

(*1*) 12. What are the missing numbers?

$$5\,\overline{)\,?\;5\;1\;5}\quad\text{quotient: } ?\;9\;?\;?$$

______

(*1*) 13. What is the square of the square of the square of 20? ______

(*4*) 14. What are the two possible sets of numbers which can be substituted for the letters? Hint: E equals 4.

$$\begin{array}{r} C\;A\;N \\ W\;E \\ \hline X\;X\;X\;X \\ X\;X\;X\;X\;\;\; \\ \hline D\;A\;N\;C\;E \end{array}$$

(*3*) 15. Give the next three letters in this progression: O T T F F S S ? ? ? ______ ______ ______

(*3*) 16. How is 1959 written in binary numbers? ______

(*2*) 17. The Phoenicians were the first people to produce soap on a commercial scale; Jas. Pyle and Sons was the first U.S. company to produce soap powder. How many years elapsed between these two business ventures that both involved soap? ______

(*3*) 18. How many years elapsed between the discovery of the neutron and the time the first nuclear reactor went critical? ______

(*1*) 19. What is the primary standard of weight in the United States and where is it kept? ______

(*10*)*20. Cut 5 folding 4″ cubes; each from a different pattern, each from 1 piece of paper.

(*3*) 21. What are the missing numbers?

$$\begin{array}{r} ?\;?\;? \\ \times\;\;?\;? \\ \hline ?\;?\;9 \\ 4\;?\;?\;4\;\;\; \\ \hline ?\;?\;3\;4\;? \end{array}$$

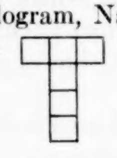
Scoring: It is possible to earn 55 points:
40 to 55 points is excellent
30 to 39 points is good
20 to 29 points is fair

Scavenger Hunt 3 Answers

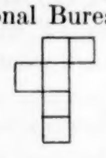
1. $30\times1.1516=34.5480$ 2. Denver or somewhere in Colorado 3. 4,200 ft. 4. $[(3+3)]\div.3-3=17$, $3^3+\frac{3}{3}=28$, $3^3+\sqrt{3\cdot3}=30$, $33+(3\div.3)=43$ 5. (Points given at the discretion of the teacher.) 6. 8,000 7. 1.620 oz. 8. 61 (1899) 9. 53,329 T 10. 5 million 11. $16{,}797-8{,}249=8{,}548$ 12.

$$5\,\overline{)\,9\;5\;1\;5}\quad\text{quotient: } 1\;9\;0\;3$$

13. 25,600,000,000 14. 831×64 or 621×84 15. E, N, T for 8, 9, 10 16. 11, 110, 100, 111 17. 2,457 yrs. (600 B.C.-1857) 18. 10 years (1932–1942) 19. Kilogram, National Bureau of Standards 20.



or



etc. 21.

$$\begin{array}{r} 709 \\ 16 \\ \hline 709 \\ 4254\;\; \\ \hline 11344 \end{array}$$

Scavenger Hunt 4

Have you been on a winning team? Have you discovered how helpful your father or your mother or an aunt, an uncle or some good friend's friend can be? Do you know the librarian at your school and in your town library? Do you own an almanac? Have you found out that sometimes encyclopedias will give different information about the same topic? Have you made good use of the indexes? Have you learned to read an unabridged dictionary? Are you accurate in your computation?

The same rules apply for this hunt as for Hunts 1 and 2.

Beginning time for this hunt: ________

Ending time for this hunt: ________

Questions

(*2*) 1. The speedometer needle of the Isetta read 170! Of course, that was kilometers per hour. How many miles an hour was the car traveling? ______

(*4*) 2. Skip and Sherman were walking to Paris. The road sign said "50 kilometers to Paris." If they walked a steady 4 miles an hour, how long would it take them to reach Paris? ______

(*1*) 3. Mr. Parsons filled his empty tank with 20 gallons of gas in Montreal. How many gallons would fill his empty tank in Albany, New York? ______

(*3*) 4. A 2-horsepower lawn mower runs for 1 hour. How many foot-pounds does that equal? ______

(*2*) 5. 100 centimeters equals 3.2808 feet
10 centimeters equal? ______
1 centimeter equals? ______
1,000 centimeters equal? ______
50 centimeters equal? ______

(*1*) 6. $7 \times 15{,}873$ equals 111,111
$? \times 15{,}873$ equals 222,222 ______
$? \times 15{,}873$ equals 444,444 ______
$42 \times 15{,}873$ equals? ______

(*2*) 7. *If* $\frac{1}{4}$ of 20 is 6; *then* what is $\frac{1}{4}$ of 10? ______

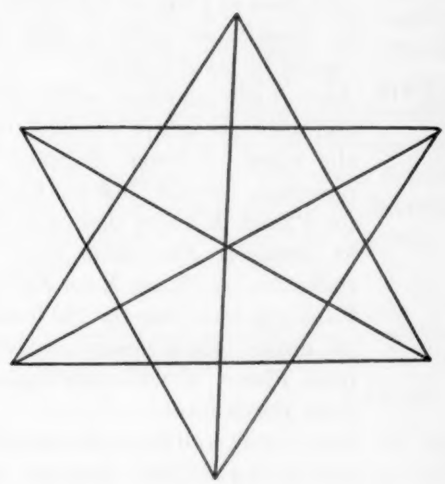
(*1*) 8. How many pairs of ribs does a bison have? ______

(*2*) 9. If two tropical islands were 140 geographical miles apart, then how many hours would it take to swim from one to the other, averaging 100 yards a minute? ______

(*1*) 10. What are the number meanings of these words?
a. tetra ______
b. quad ______
c. hexad ______
d. trente et quarante ______

(*2*) 11. What instruments measure
a. the boiling point of a liquid and thus the altitude? ______
b. the wave length of light? ______
c. the power of an engine? ______

(*2*) 12. How many triangles can you find in this figure?



(*2*) 13. If A is 15 miles south-southwest of B, and B is 7 miles west-northwest of C, and D is 9 miles north-northeast of C, how far is A from D? ______

(*4*) 14. If 1 man, or 1 woman, can hoe $\frac{1}{2}$ acre in 3 hours, answer the following. How long will it take 6 men and 8 women to hoe 10

acres, if the men work continuously but the women knock off for 10 minutes after each hour of work? ______

(*4*) 15. What is Archimedes' principle about buoyancy? ______________________

(*3*) 16. Use the article on the State of Washington in the 1957 edition of the *World Book Encyclopedia* to answer these questions:
a. What is the average value of the apple crop? ______
b. What part of the State has a growing season of more than 219 days? ______

(*1*) 17. For land use in Wisconsin, what per cent does the *World Book Encyclopedia* say is crop land? ______

What per cent does *Compton's Encyclopedia* say is crop land? ______

(*15*)*18. Draw to scale a floor plan of the first floor of your school building or some more suitable area assigned by your teacher.

(*5*)*19. Answer this question with a neat and accurate graph which shows the correct answer: Suppose a passenger rocket leaves Earth for Planet X every day at noon at precisely the same time a rocket leaves Planet X for Earth. Each trip lasts exactly 192 hours (8 days). How many rockets from Planet X will each rocket from Earth meet? ______

(*3*) 20. Skip, Peter, and Sherman bought a farm for $5,000. Not one of them had enough to buy it alone, but Skip could pay for it alone by borrowing one-third of Peter's money and one-half of Sherman's money. Peter could pay for it by borrowing one-half of Skip's money and only one-fourth of Sherman's money. Sherman could pay for it by borrowing one-fourth of Skip's money and just one-sixth of Peter's money.
How much money does Skip have? ______
How much money does Peter have? ______
How much money does Sherman have? ______

Scoring: It is possible to earn 60 points:
45 to 60 points is excellent
35 to 44 points is good
25 to 34 points is fair

Scavenger Hunt 4 Answers

1. $170 \cdot .9113 = ? \cdot .6818 = 105.625$ m.p.h. 2. $50 \cdot .6214 = ? \div 4 = 7.7675$ (Accept 8 hours.) 3. $20 \cdot 1.20094 = 24.01880$ (Accept 24 gallons.) 4. $2 \cdot 33{,}000 \cdot 60 = 3{,}960{,}000$ foot-pounds 5. .32808, .032808, 32.808, 1.6404 6. 14, 28, 666,666 7. 3 8. 14 9. 47.3 (Accept 47 to 48.) 10. 4, 4, 6, 30+40 11. Hypsometer, interferometer, dynamometer 12. 56 13. 25 miles 14. 4 hours 40 minutes 15. 8.5 16. $7,000,000, west coast, 8,266,444 17. 31% 18. (Points at the discretion of the teacher.) 19. (Points at the discretion of the teacher.) 20. $2,000, $3,000, $4,000

Mathematics only records business; it does not conduct it.
—Benjamin Franklin

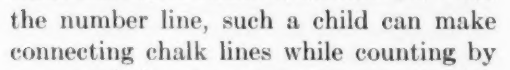
The number line in the primary grades

ROBERT B. ASHLOCK *Noblesville, Indiana*
Mr. Ashlock is principal of Federal Hill School, Noblesville, Indiana.

If new arithmetic processes are to be introduced successfully in the primary grades, pupils must understand the number system thoroughly. The number line can often be used to deepen understandings, through experiences which follow initial concrete manipulation but precede the more abstract computational problems.

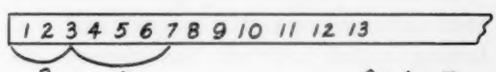
For maximum convenience, a number line can be attached to the chalkboard. If a number line is painted across the chalkboard, contrasting colors should be used for tens and ones. As can be seen in the illustrations which follow, the teacher and children can easily swing a chalk line under or over the number line to indicate quantities. These chalk lines can then be erased without destroying the number line.

The number line can be used to strengthen the child's mental image, thereby developing the ability to compute mentally. Many children even in the third and fourth grades cannot visualize the placement of specific numbers within the number system. For example, a child may insist that 68 is closer to 60 than 70. With the number line, such a child can make connecting chalk lines while counting by ones, and then by tens. The quantitative differences are sensed by the varied rhythms and sizes of connecting lines.



Next, the number 68 can be analyzed. The child may already know that 68 is 6 tens and 8 ones. But drawing connecting lines in order to count 6 tens and then 8 ones beyond helps build the proper quantitative relationships. The position of the 70 in the number line emphasizes that 68 is "almost 70" and makes possible sensible estimating.

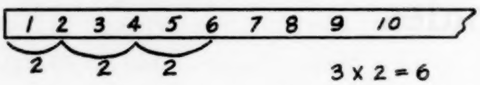
Children begin understanding addition through concrete experiences. Perhaps they count a group of 3 objects, and another of 4 objects, then put them in one pile and count seven objects in all. Later a counter may be used which helps the child visualize the objects in a row. The number line then substitutes figures for the objects and indicates the sum at any given point along the row of objects. Connecting chalk lines may again be used by the child as he swings under the distance of 3 numbers, and then under four more. The number line then tells him that his sum is seven.



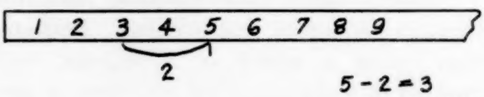
Column addition may be illustrated similarly.

The number line can also add to the child's understanding of multiplication as the totaling of a quantity of equal-sized groups. As the child swings under the number line with connecting chalk lines, the length of the swing illustrates the size of the multiplicand, the number of swings totals the multiplier, and the end of the chalk line points to the product. As the

child draws, he can count, "One two, two twos, three twos."

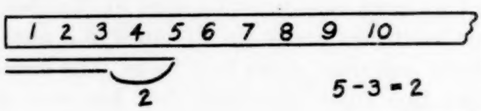


Though the number line is most obviously useful in building addition and multiplication concepts, it is equally useful in subtraction and division. As in the case of addition, many children will need to experience subtraction through concrete objects and then counters. The number line can be used to introduce figures into the subtraction process. The child can indicate the original quantity with a chalk mark, then take away by drawing a connecting line to the *left*. His chalk line will point to the remainder.



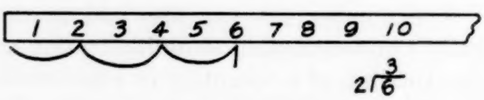
REMAINDER

In order to find the difference when comparing two quantities, bar lines illustrating these quantities may be drawn under the number line. The difference may then be noted.

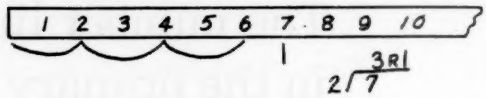


DIFFERENCE

Division concepts may also be strengthened through use of the number line. Following initial concrete experiences, the child may show how many twos are in six. A chalk mark can indicate initial quantity and the child counts, "One two, two twos, three twos."



Uneven division concepts are easily visualized. After an initial quantity is indicated, groups can be counted—but not beyond the initial quantity. The remainder is then observed by the child.



Though one of the least expensive yet easily made visual aids, the number line is one of the most useful in teaching primary arithmetic. By using it properly, we will increase the effectiveness of our teaching in the primary grades—and in the levels which follow.

Notice of Annual Business Meeting

The Annual Business Meeting will be held at the Conrad Hilton Hotel in Chicago on April 6, 1961. This meeting will be one of special significance to the members of the Council, for at this time proposed amendments to both the Bylaws and the Articles of Incorporation will be presented.

For some time the Board of Directors has felt that the objectives of the Council could more readily be realized if certain changes were made in the Bylaws. In the fall of 1959, a Bylaws Revision Committee was appointed. As the result of much study and deliberation by both the committee and the Board of Directors, certain important revisions have been prepared for the consideration of the members.

It is important for several reasons that a nonprofit organization such as ours have a tax-exempt status under the Internal Revenue Code. The Council, since it became a department of the National Education Association, has been able to take advantage of the latter's tax exemption. However, it is questionable whether this practice could be adequately defended before the courts if it were challenged. So that the Council may apply for its own independent tax exemption, certain amendments of the Articles of Incorporation are required. These amendments have been worked out in consultation with an attorney and have been approved by the Board of Directors.

A statement of the proposed amendments both of the Bylaws and the Articles of Incorporation will be mailed from the Central Office to each member of the Council on February 27. It is hoped that every member will study these materials thoughtfully and that a large group of members will be present to discuss and make decisions on them at the Annual Business Meeting on April 6.

M. H. Ahrendt, Executive Secretary

Independent work in arithmetic

EDWINA DEANS
Arlington Public Schools, Arlington, Virginia

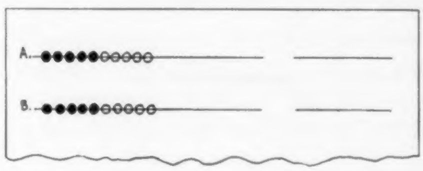
Elementary teachers find it necessary to work with a small group of children during a portion of the time devoted to arithmetic instruction. When the teacher is working directly with one group, there is a need for others in the class to be profitably engaged in some type of work in arithmetic. Independent work, to be of value, must be challenging and must provide practice on skills and abilities which have been well taught and thoroughly understood. It should provide maximum practice for children with a minimum expenditure of time for the teacher.

Ideas for good independent work may be drawn from a variety of sources. These may include the following:

1. Practice work in text materials
2. Arithmetic games and puzzles or similar materials arranged on an arithmetic table
3. Arithmetic problems composed by children using data from science and social studies content or from home and school experiences
4. Projects on the history of time, money, the calendar, early number systems, measures of length, etc.
5. Scrapbooks or files developed from old arithmetic textbooks, current workbooks, current uses of arithmetic as gathered from newspapers, magazines, and other sources.
6. Worksheets designed by the teacher to develop certain specific abilities.

In an effort to meet an expressed need of many elementary teachers, this issue deals with one type of independent work—the worksheet devised to be used in several ways and designed to meet more than one purpose or need. Certainly many arithmetic worksheets in daily use by children demand hours of the teacher's time in preparation but require little effort on the part of children. The six worksheets which are described here represent types which can be adapted for developing several different abilities. The use of oral instructions, chart, or chalkboard, makes it possible to use the same material in a number of ways. Perhaps these illustrations will stimulate you to think of many others.

1. A worksheet of number beadlines to 10.



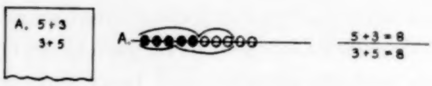
It is assumed that children will know the make-up of the number beadline from class instruction. Possible ways of using the worksheet include the following:

a. Use the beadlines to show addition facts for any number. The number desired may be indicated on the chalkboard. If the number is 7,

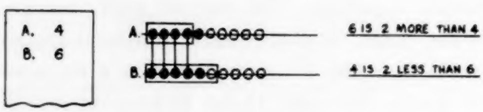
children will use Row A to show one addition fact for 7, Row B to show another, etc. Each fact shown may be recorded at the right.

b. Show subtraction facts for any number.

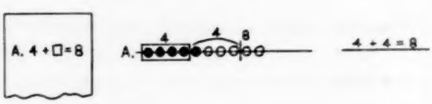
c. Use the same number line to show two related addition facts. Indicate facts to be shown on chart or chalkboard.



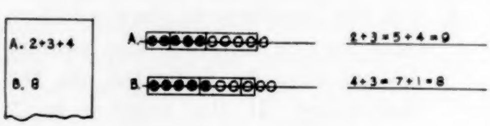
d. Use two number beadlines to compare two numbers. Have children find how many more or how many less one number is than the other. Show numbers to be compared on chart or chalkboard.



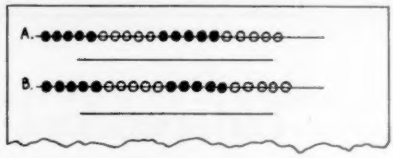
e. Show number sentences with missing numbers. Place number sentences on chart or chalkboard.



f. Use the number beadlines to show the addition of three numbers. List the numbers to be added, or indicate the total desired, and have children find the total or think out subgroups to give the total.

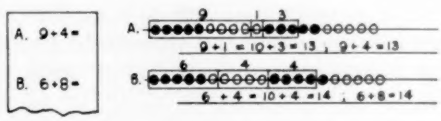


2. A worksheet of number beadlines to 20.

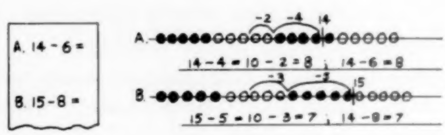


Use the 20-number beadline worksheet to provide practice on facts and processes similar to those suggested for the 10-number beadline worksheet. Other activities made possible by the 20-number beadline follow.

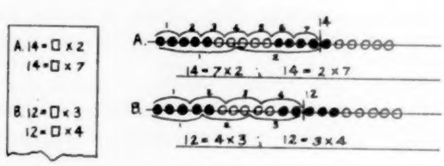
a. Show addition facts by indicating the number needed to make 10 and then adding the rest to complete the sum. List facts on chart or chalkboard.



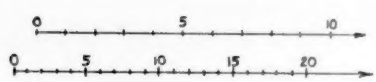
b. Show subtraction facts by subtracting to get 10 and then subtracting the rest.



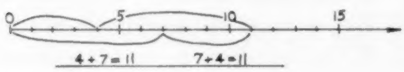
c. Use the number beadlines to show equal groups for given numbers. Indicate the equal groups on a chart or chalkboard. Use the same number beadline to show two facts.



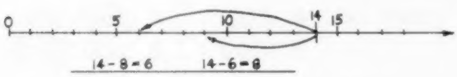
3. As children grow in understanding, provide number lines beginning with a zero point and continuing through 10 or 20.



Adapt the activities suggested for number beadlines to point number lines. For addition children start at zero and move to the right to show the addends



and the sum. For subtraction children begin with the amount of the minuend, move to the left the amount of the subtrahend to find the remainder,



4. Following meaningful instruction on addition, provide children with worksheet forms for an addition fact chart.

+	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

a. Insert answers to addition facts on the chart. The first addend is found at the left and the second at the top. The answer is placed in the square representing the intersection of the two rows. List facts for which answers are to be inserted on a chart or chalkboard. Placement of answers may be checked by means of a master copy complete with answers.

b. Children may invent games to play with partners. For example, they may draw fact cards and insert answers in the proper squares. If a child misplaces an answer, his partner gets an extra turn. Partners initial their squares. The partner with the most squares filled wins.

c. Provide children with sets of answers. Have them find all the squares in which the answers may be correctly placed and write the facts which give each sum. The completed chart for 9, 11, and 14 follows.

+	0	1	2	3	4	5	6	7	8	9
0										9
1									9	
2								9		11
3							9		11	
4						9		11		
5					9		11			14
6				9		11			14	
7			9		11			14		
8		9		11			14			
9	9		11			14				

9 = 0+9
= 1+8
= 2+7
= 3+6
= 4+5
= 5+4 etc.

11 = 2+9
= 3+8
= 4+7 etc.

14 = 5+9
= 6+8
= 7+7 etc.

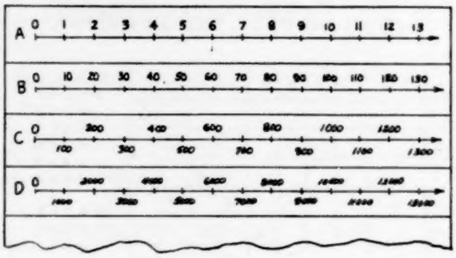
d. The chart may be started as a directed lesson and completed independently. Children may list interesting observations and patterns discovered from the chart.

e. Use the completed chart for checking answers to subtraction facts. Suppose the fact to be checked is 14−6. Find 14 in the row with 6 at the left of the chart. Follow from 14 to the number at the top (8). This is the answer to the fact 14−6.

5. Experiences similar to the ones described for addition may be adapted for a multiplication fact chart, following meaningful instruction on multiplication facts. Numbers at the left represent the number of groups desired. The numbers at the top represent the size of the group. The answers as placed in the square represent the intersection of the horizontal and vertical rows.

x	0	1	2	3	4	5	6	7	8	9
0										
1										
2										
3										
4										
5										
6										
7										
8										
9										

6. **Provide a worksheet to help children with rounding numbers.**



a. **Through oral discussion make certain that children understand that the arrows indicate that the number line continues indefinitely. Call attention to the difference between any two points on each line. List sets of two numbers on chart or chalkboard. Have children indicate the number which is halfway between the numbers listed.**

120 — 130	200 — 300
460 — 470	500 — 600
500 — 510	1700 — 1800

0 — 1000
3000 — 4000
20,000 — 21,000

b. List sets of two numbers on chart or chalkboard. Have children indicate the numbers which would fall at three points between each two numbers, dividing each space into four equal parts.

200 — — — 300
1000 — — — 2000
2500 — — — 2600

0 — — — 1000
1000 — — — 2000
20,000 — — — 21,000

c. As children understand that each number line continues indefinitely, they will become aware of the following relationships:
The one's line would eventually contain all the numbers on the other number lines. The ten's line would eventually contain all the numbers on the hundred's and thousand's line, etc. In other words 900 can be thought of as 90 tens, 4000 as 400 tens or 40 hundreds, etc.

d. Write numbers to be considered on a chart or chalkboard. Have children write the two numbers between which the number would fall and circle the number which is closest.

TEN'S LINE: A. 603	A. 600 610
B. 1009	B. 1000 1010
HUNDRED'S LINE: C. 3040	C. 3000 4000
D. 2915	D. 2900 3000

The child's work may be placed directly on the worksheet under the number lines to encourage the use of the number lines in determining the direction for rounding a number.

e. Place numbers on the chalkboard and have children write the two numbers between which it would fall on the ten's line, the hundred's line, and the thousand's line. Have them circle the number to which each is closest.

A. 3609 A. TEN'S LINE: 3600 3610
HUNDRED'S LINE: 3600 3700
THOUSAND'S LINE: 3000 4000

To summarize: The teacher's time is extremely valuable. Time saved by developing worksheets to serve many purposes may be better used in planning careful oral discussions, class discovery procedures, and ways of meeting the needs of individual differences in the classroom.

Some of the ideas used in the illustrations for this article are adapted from material developed by Richard Hackenbracht, and Claude C. Harris, participants in the Elementary Mathematics Institute at Ann Arbor, Michigan, summer, 1960. Their contribution is gratefully acknowledged.

Analysis of research in the teaching of mathematics: 1957 and 1958

J. FRED WEAVER
Boston University, Boston, Massachusetts

Readers of THE ARITHMETIC TEACHER will be interested in a recently published report, *Analysis of Research in the Teaching of Mathematics: 1957 and 1958*, prepared by Kenneth E. Brown and John J. Kinsella.* Dr. Brown is specialist for mathematics, Office of Education, U.S. Department of Health, Education, and Welfare; Prof. Kinsella, of the Department of Science and Mathematics Education of the New York University School of Education, is chairman of the Research Committee of the National Council of Teachers of Mathematics.

The following excerpts from the Foreword and the Introduction to the report make clear its purpose and scope:

The increased competition in technical advancement has made the need for high quality scientists, engineers, and technicians stand out in bold relief. Better instruction in mathematics in our public schools can make a contribution to the quality of our scientific personnel. If research findings are implemented in the classroom they likewise can make a contribution. The purpose of this study is to help implement research findings by making available the results of research in the teaching of mathematics that have been reported to the Office of Education during the calendar years 1957 and 1958.

It was for the purpose of disseminating the findings of research on the teaching of mathematics that the Office of Education in cooperation with the National Council of Teachers of Mathematics reported summaries of research in mathematics education in 1952 (Circular No. 377) and in 1954 (Circular No. 377-II). These summaries received many favorable comments and suggestions from readers in mathematics education. As a result of the suggestions, the Office of Education and the Council cooperated further by summarizing research completed in mathematics education during the 2-year period 1955–1956 and also in analyzing the material.

To assist in the collection and dissemination of research findings in the teaching of mathematics [for the current report for 1957–1958], the U. S. Office of Education with the aid of the Research Committee of the National Council of Teachers of Mathematics sent an inquiry to 817 colleges that offered graduate courses in mathematics or whose staffs had made previous contributions in this field. The committee received answers to the questionnaire from 399 colleges. Of the 399 colleges, 59 reported research in the teaching of mathematics. The Committee carefully studied the 111 research studies reported by these 59 colleges and selected 73 of them for inclusion in this analysis. Those that were selected are 14 studies by college faculty members, 32 doctoral dissertations, and 27 master's theses. A summary of each is included in the appendix.

[The studies] . . . are presented according to pertinent questions in mathematics education. Although there is considerable overlapping when the 73 studies are classified according to grade levels, the questions and analyses are reported under three headings: Research in the Teaching of College Mathematics; Research in the Teaching of High School Mathematics; and Research in the Teaching of Elementary School Mathematics. The college level contains 23 studies; the high school level, 28; and the elementary, 22.

* Bulletin 1960, No. 8. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., @ 25¢ per copy.

The following 13 questions serve as the basis for summarizing and analyzing the 22 studies at the elementary-school level:

1. *What factors seem to have the greatest influence on success in arithmetic problem-solving?*
2. *Are lessons in mental arithmetic of much value?*
3. *Do seventh and eighth grade pupils understand the concepts involved in computation?*
4. *What is the most effective way of dividing the time between the development of meanings and computational practice in the intermediate grades?*
5. *Should the concept of a fraction as a ratio be emphasized at the fifth grade level?*
6. *What is the best way to teach the location of the decimal point in division?*
7. *Is homogeneous grouping in mathematics classes effective at the seventh grade level?*
8. *Should a variety of teaching aids be used in arithmetic instruction?*
9. *What is the best way to teach the concept of area at the fifth grade level?*
10. *What mathematics should be taught to superior pupils in grades 7 and 8?*
11. *Are 50-minute daily arithmetic periods much better than 40-minute periods?*
12. *How are gains in arithmetic achievement at the eighth grade level related to intelligence levels?*
13. *What changes have taken place in arithmetic as a school subject since 1900?*

Readers of The Arithmetic Teacher will wish to refer directly to the Brown-Kinsella report to see the extent to which research has given us valid and reliable answers to these questions.

Portions of the report's brief section on Recommendations for Future Research are worthy of special mention here:

> The recommendations for research in mathematics education made in 1955–56 apply to 1957–58 as well. Three major points were (1) that crucial problems should be the subjects of investigation; (2) that more research should be of the cooperative, team-like type; and (3) that the results of research should be clearly and adequately reported.
>
> Some crucial problems were attacked in 1957–58 ... [However,] as in 1955–56 there does not seem to be one reported research study involving the active team-work of two or more investigators. As a result, most of the studies reported are, in general, narrow in scope, limited in duration, restricted to only a few teachers, and carried out in a constricted geographical area.
>
> *The results of research cannot be clearly and adequately reported in pamphlets like this unless the needed information is supplied. As a minimum, the problem and subproblems should be clearly stated; the number and characteristics of the subjects of the experiment, including the teachers, should be provided; the duration of the experiment should be specified; the methods or treatments used should be clearly described; the method of sampling should be spelled out; the validity and reliability of evaluation instruments should be given; and the findings should be separated from the conclusions and recommendations.* (Italics mine.—Editor.)

The preceding paragraph applies equally well to the reporting of experimental research in The Arithmetic Teacher. The value of our research reports is in direct proportion to the degree to which they meet the conditions or criteria cited above. With your help we can make The Arithmetic Teacher the leading source of significant reports of research, experimental and otherwise, in elementary-school mathematics.

Professional dates

The information below gives the name, date, and place of meeting with the name and address of the person to whom you may write for further information. For information about other meetings, see the previous issues of The Arithmetic Teacher. Announcements for publication should be sent at least ten weeks early to the Executive Secretary, National Council of Teachers of Mathematics, 1201 Sixteenth Street, N.W., Washington 6, D.C.

NCTM convention dates

Thirty-ninth Annual Meeting

April 5–8, 1961
Conrad Hilton Hotel, Chicago, Illinois
Robert Sisler, Morton High School West, 2400 Home Avenue, Berwyn, Illinois

Joint Meeting with NEA

June 28, 1961
Atlantic City, New Jersey
M. H. Ahrendt, 1201 Sixteenth Street, N.W., Washington 6, D.C.

Twenty-first Summer Meeting

August 21–23, 1961
University of Toronto, Toronto, Canada
Father John C. Egsgard, St. Michael's College School, 1515 Bathurst Street, Toronto 10, Canada

(For other meeting dates, see page 85.)

Books and Materials

Edited by
CLARENCE ETHEL HARDGROVE
Northern Illinois University, DeKalb, Illinois

The Arithmetic Handbook, Martin H. Ivener. Box 251, North Hollywood, Calif.: Martin Publishing Company, 1960. Paper, 60 pp., $1.00.

This booklet is written in the style of a dictionary. Over four hundred terms related to arithmetic and its use are alphabetically arranged and described. The last fifteen pages list tables for quick reference.

As one thumbs through the booklet, he may not be too favorably impressed with the choice of terms nor with some of the "definitions." The "definitions" are sometimes brief, incomplete, and rather narrow. Often two or more meanings are included for each term and some illustrations are given.

The following terms illustrate the different styles used:

ANSWER n.—the solution to a problem. NEAREST adj.—closest. GRAPH PAPER—paper ruled in both directions useful in making graphs. HEXAGON n.—1. a closed, plane figure with six sides and six angles.; 2. a six-sided polygon. INTEGER n.—1. a whole number.; 2. a number in the set $\cdots, -3, -2, -1, 0, 1, 2, 3, \cdots$. COMMUTATIVE LAW—The order of numbers may be reversed when multiplying or adding, e.g., $7\times2=2\times7$; $4+3=3+4$; $ab=ba$; $a+b=b+a$. TRIGONOMETRY n.—the branch of mathematics pertaining to triangles and measures and ratios pertaining to them. DISCOUNTED NOTE—a promissory note which is sold for less than its face value, the difference between the price and the face value representing interest.

Such "definitions" will cause different reactions among different people. Careful study of the content indicates a selection of terms most commonly used in elementary-school arithmetic. Even though the "definitions" may not be completely satisfactory to a mathematician, there are indications that the author has striven for accuracy and simplicity as far as his statements go. He has checked the use of the material with pupils and teachers. The more one studies the total work the more one can see some possibility of usefulness of the list as a handy reference for a teacher and his pupils. Some teachers will appreciate the tables, formulas, and decimal equivalents which are included.

If one is looking for a handy reference for arithmetic terms in common use, it is well to investigate this booklet. If one is looking for a dictionary of arithmetical terms, he should look elsewhere.

FRANCIS R. BROWN
Illinois State Normal University
Normal, Illinois

Elementary and Junior High School Mathematics Library, Clarence Ethel Hardgrove. Washington, D.C.: The National Council of Teachers of Mathematics, 1960. Paper, 32 pp., $0.35.

Teachers throughout the country are looking for enrichment activities to use in arithmetic programs. This bibliography should prove helpful to these teachers and to librarians and parents for it lists read-

ing materials which require the use of mathematical concepts and quantitative thinking appropriate for primary, intermediate, and junior high school students. All books are annotated and grade placements are suggested for the convenience of the teacher.

At the primary level 72 titles are listed, dating from 1928 to 1959. A variety of subjects is included and various concepts are illustrated, such as counting, measurement, time, position, size, one-to-one correspondence, comparisons, quantity, groups, light and heavy, shapes, and money value.

At the intermediate level 65 titles are listed. They range in copyright dates from 1937 to 1959. In this area the book *Magic House of Numbers* by Irving Adler gives enrichment activities in the form of riddles, tricks, and games which have an appeal to children at this level. Intermediate-grade children begin to be interested in historical events. *How Much and How Many* by Jeanne Bendick deals with the historical background of weights and measures. Books concerned with geometric concepts, scale drawings, the application of mathematics to music, bank activities, and the use of multiplication for devising and breaking codes, as well as books dealing with an extension of many of the concepts listed at the primary level, are included at the intermediate level.

At the junior high school level there are 95 books dating from 1924 to 1960. Several books are included which will be of interest to the more able child, including the history of our number system, brain twisters and puzzles, the way mathematicians think, and the times when mathematics can be of use. There are also recommended biographies such as *Albert Einstein* by Arthur Beckhard and *Galileo and the Magic Numbers* by Sidney Rosen. For children who like to do things there are cookbooks and other how-to-do-it books. Those who are looking for modern ideas on mathematics could examine *The New Mathematics* by Irving Adler.

Mathematics books for every child are included in the bibliography. There are many books which will cut across other subject areas in the school program, such as science and social studies. The bibliography is partially based on existing bibliographies. A few out-of-print books are included but possibly remain in many libraries. This bibliography fills a gap in our educational program by listing books which will give depth and breadth to our elementary mathematics curriculum at all levels.

FRANCES L. DAMM
Illinois State Normal University
Normal, Illinois

Geometry for Juniors, Grace A. Moss. Oxford, England: Basil Blackwell, 1960. Paper, 4 booklets 36 pp. each, 3/6 each; Teachers' Book, 10 pp., 1/-.

Geometry for Juniors provides interesting materials for teachers of pupils in the intermediate grades. The ideas, of course, could readily be adapted for use with junior high school pupils even though the context may have been designed for younger readers.

The four booklets in the set contain fascinating things for pupils to do in informal geometry. The pupils could work singly, in pairs, or in larger groups. The pages resemble study guides; there are specific directions so that the pupils know exactly how to proceed.

Drawing, measuring, coloring, folding, cutting—all help children to discover geometrical relations. Symmetries, reflections, curve stitchings, graphs, scale drawings, simple nomographs, and loci develop from direct, intuitive beginnings. Visual aids, such as mirrors, area boards, inch squares, inch cubes, Meccano strips, squared paper, as well as the usual geometric tools, get full use.

Materials of the nature of these small books necessarily emphasize "do thus-do so." *Geometry for Juniors* is by no means

mere busywork, however. The books encourage children to make geometrical discoveries for themselves. The advantages of such learnings over the meager outcomes of "teacher-tell-teacher-show" procedures are patent.

Fortunately, the few questionable places in the text can be readily altered as the teacher sees fit. On page 3, Book 1, for example, "squares or rectangles" may suggest that these classes of polygons are mutally exclusive. Page 29, Book 2, contains a reference to "a set square with two inch sides," when "arms" or "legs" would have been more precise than "sides." On page 26, Book 3, the pupil is directed to estimate the length of a curve and then to check his estimate by measuring a string that had been put along the curve. This is satisfactory, except that "stretching" the string (as directed) to measure it will likely alter its length. Page 32, Book 4, contains a reference to boxes as "cuboids." This usage is not at all erroneous, but teachers might observe that "rectangular solid" has a place too.

Indeed, the foregoing observations do not really constitute criticisms. Rather they suggest that the teacher who uses the books in the United States of America will necessarily alert pupils to differences in usage between British and American writers. Money, notation for the time of day, spelling, choice of words, and other items differ in the two lands, and who are we to dub either linguistic choice as correct?

With an occasional help from their teachers, in fact, pupils in America can gain from *Geometry for Juniors* not only an extensive foundation in geometrical understandings, but also a bit of appreciation for the laudable ways of their British cousins. Both, this reviewer suggests, merit our most sincere efforts.

IRVIN BRUNE
Iowa State Teachers College
Cedar Falls, Iowa

Books received

Arithmetic Charts Handbook, Enoch Dumas, Charles F. Howard, and Jean E. Dumas. San Francisco: Feron Publishers, Inc., 1960. Paper, 64 pp., $1.50.

Arithmetic Games, Second Edition, Enoch Dumas. San Francisco: Feron Publishers, Inc., 1960. Paper, 56 pp., $1.50.

Arithmetic Learning Activities, Enoch Dumas. San Francisco: Feron Publishers, Inc., 1957. Paper, 60 pp., $1.50.

How To Meet Individual Differences in Teaching Arithmetic, Enoch Dumas, Jack Kittell, and Barbara Grant. San Francisco: Feron Publishers, Inc., 1957. Paper, 58 pp., $1.50.

How To Use the Arithmetic You Know, Geoffrey Mott-Smith. New York: Sterling Publishing Co. Cloth, 128 pp., $2.95.

Mathematics for the General Reader, E. C. Titchmarsh. New York: Doubleday and Company, Inc., 1959. Paper, 197 pp., $.95.

Money Makes Sense, Charles H. Kahn and J. Bradley Hanna. San Francisco: Feron Publishers, Inc., 1960. Paper, 140 pp., $2.

The Number Story, Herta Taussig Freitag and Arthur H. Freitag. Washington, D.C.: National Council of Teachers of Mathematics. Paper, 76 pp., $.85.

(Professional dates cont'd.)

Sectional meetings of the Illinois Council of Teachers of Mathematics

There will be six sectional meetings of the Illinois Council of Teachers of Mathematics in March and April, 1961. Themes of these meetings include: "Function of Modern Mathematics," "Meeting Today's Challenges in Mathematics," and "Recent Developments in Teaching of Mathematics." These meetings are specifically designed for teachers at the elementary, secondary, and college levels. The dates, places, and chairmen of the meetings are:

March 25: Monticello College, Godfrey, Ill.; Evelyn Trennt
April 1: Southern Illinois University, Carbondale; W. C. McDaniel
April 14: Eastern Illinois University, Charleston; Alphonso DePietro
April 15: Western Illinois University, Macomb; Jerry Shyrock
April 22: Illinois State Normal University, Normal; Hal Gilmore
April 29: Sterling Township High School, Sterling; Charles E. Schulz and Chester Sherman

For detailed information please write to the chairman of the specific meeting.

For general information, write to: T. E. Rine, Chairman of Public Relations, Illinois Council of Teachers of Mathematics, Illinois State Normal University, Normal, Illinois.

Committees and Representatives, 1960–1961

At their meetings in December, 1959, and April, 1960, the Board of Directors of NCTM made a careful study of the committee structure of the National Council of Teachers of Mathematics. The chief purposes of this reorganization were:

1. To provide the Board of Directors with more time and background information as they consider basic policies and action proposals. This is obtained by having subcommittee reports analyzed and synthesized by the major committees prior to submission to the Board.
2. To provide both effective action and thoughtful search for new projects by defining committee tasks more clearly, eliminating overlapping, and extending financial support. Several important committees have had broad charges and made extensive recommendations. It is hoped to encourage continued thought for broad and sweeping plans while also providing implementation for them by defining more sharply the tasks of major committees and providing ad hoc committees to execute projects which they conceive.

This study resulted in a reorganization of many committees into five major committees, namely,

1) The Executive Committee
2) Professional Standards Committee
3) Professional Relations Committee
4) Publications Committee
5) Plans and Proposals Committee.

The definitions of the tasks of the following committees and the assignment of ad hoc committees to carry out their recommendations are still under consideration by the appropriate major committees: membership, teacher education and certification, relations with industry, international relations, and television. It should be clear that these committees represent important NCTM interests, and they have made extensive reports which, it is hoped, can now be further implemented.

Appointments for 1960–1961 follow.

Executive Committee

Philip Peak, Bloomington, Indiana (1961)

Henry Van Engen, Madison, Wisconsin (1961)

Secretary of the Board

Houston T. Karnes, Baton Rouge, Louisiana

Publications Committee

Henry Swain, Winnetka, Ill. (1961) Chairman

Donovan A. Johnson, Minneapolis, Minn. (1963)

Paul Johnson, Los Angeles, Calif. (1963)

Ben A. Sueltz, Cortland, New York (1962)

Henry Van Engen, Madison, Wis. (1962)

Ex officio nonvoting members:

Myrl H. Ahrendt, Washington, D.C., Executive Secretary

Robert E. Pingry, Editor, *The Mathematics Teacher*

E. Glenadine Gibb, Editor, THE ARITHMETIC TEACHER
W. Warwick Sawyer, Editor, *The Mathematics Student Journal*

Plans and Proposals Committee

Robert E. K. Rourke, Kent, Conn. (1962), Chairman
Roy Dubisch, Fresno, Calif. (1962)
William Matson, Seattle, Wash. (1963)
Henry Van Engen, Madison, Wis. (1961)
Edwin E. Moise, Cambridge, Mass. (1961)

Professional Status and Standards Committee

John R. Mayor, Washington, D.C. (1962), Chairman
W. T. Guy, Jr., Austin, Texas (1962)
Frank B. Allen, La Grange, Ill. (1963)
Henry Syer, Kent, Conn. (1961)
Mildred Keiffer, Cincinnati, Ohio (1963)

Professional Relations Committee

Irvin Brune, Cedar Falls, Iowa (1962), Chairman
J. Houston Banks, Nashville, Tenn. (1962)
Joseph F. Senta, St. Paul, Minn. (1963)
Veryl Schult, Washington, D.C. (1963)
Howard Fehr, New York, N.Y. (1961)

Nominations and Elections Committee (1961)

Oscar Schaaf, Eugene, Ore., Chairman
Harold Fawcett, Columbus, Ohio
W. Eugene Ferguson, Newton, Mass.
Lenore John, Chicago, Ill.
Houston T. Karnes, Baton Rouge, La.
W. C. Lowry, Charlottesville, Va.
Ida B. Puett, Atlanta, Ga.
Max Sobel, Fair Lawn, N.J.
Lottchen Hunter, Wichita, Kan.

Nominations and Elections Committee (1962)

W. Eugene Ferguson, Newton, Mass., Chairman
Mike Donahoe, Carmel, Calif.
Harold Fawcett, Columbus, Ohio
Agnes Herbert, Baltimore, Md.
Lottchen Hunter, Wichita, Kan.
Lenore John, Chicago, Ill.
W. C. Lowry, Charlottesville, Va.
Irene Sauble, Detroit, Mich.
Oscar Schaaf, Eugene, Ore.
Max Sobel, Fair Lawn, N.J.

Place of Meeting Committee

Eugene Nichols, Tallahassee, Fla. (1961), Chairman
Mabel Baker, Pittsburgh, Penn. (1961)
James Nudelman, Cupertina, Calif. (1961)
Ella S. Porter, Houston, Texas (1962)
Lauren Woodby, Mt. Pleasant, Mich. (1962)
Myrl H. Ahrendt, ex officio, Washington, D.C.

Committee on Financial Policies, Budget, and Auditing

H. Vernon Price, Iowa City, Iowa (1961), Chairman
Burton W. Jones, Boulder, Colo. (1963)
Bruce Meserve, Montclair, N.J. (1962)
Myrl H. Ahrendt, ex officio, Washington, D.C.

Reporting Elections (1961)

Oscar Schaaf, Eugene, Ore., Chairman
Phillip S. Jones, Ann Arbor, Mich.
Myrl H. Ahrendt, Washington, D.C.

Committee on Affiliated Groups

Eugene Smith, Wilmington, Del. (1961), Chairman
Mary Rogers, Westfield, N.J. (1962)
Virginia Pratt, Omaha, Neb. (1961)
Kenneth Skeen, Oxnard, Calif. (1961)
Annie John Williams, Durham, N.C. (1962)
Adeline Riefling, St. Louis, Mo. (1961)
Keene C. Van Orden, San Angelo, Texas (1963)
Catherine A. V. Lyons, Pittsburgh, Penn. (1961)

Research Committee

John Kinsella, New York, N.Y. (1962), Chairman
Kenneth Brown, Washington, D.C. (1961)
Howard F. Fehr, New York, N.Y. (1961)
Sheldon Myers, Princeton, N.J. (1962)
J. Fred Weaver, Boston, Mass. (1961)

Editorial Board of THE ARITHMETIC TEACHER

E. Glenadine Gibb, Cedar Falls, Iowa (1963), Editor
E. W. Hamilton, Cedar Falls, Iowa
Edwina Deans, Arlington, Va.
Clarence Ethel Hardgrove, DeKalb, Ill.
J. Fred Weaver, Boston, Mass.
Marguerite Brydegaard, San Diego, Calif.
John R. Clark, New Hope, Penn.
Vincent J. Glennon, Syracuse, N.Y.

Editorial Board of The Mathematics Teacher

Robert E. Pingry, Urbana, Ill. (1962), Editor
Jackson B. Adkins, Exeter, N.H.
Mildred Keiffer, Cincinnati, Ohio
Daniel B. Lloyd, Washington, D.C.
Z. L. Loflin, Lafayette, La.
Ernest Ranucci, Union, N.J.

Supplementary Publications Committee

Burton W. Jones, Boulder, Colorado (1961), Chairman
Marguerite Brydegaard, San Diego, Calif. (1962)
Kenneth Henderson, Urbana, Ill. (1962)
Margaret Joseph, Shorewood, Wis. (1962)
Jesse Osborn, St. Louis, Mo. (1961)
Helen Schneider, Oak Park, Ill. (1961)
H. C. Trimble, Cedar Falls, Iowa (1961)

Yearbook Planning Committee

Bruce Meserve, Montclair, N.J. (1961), Chairman
J. Houston Banks, Nashville, Tenn. (1962)
Ben A. Sueltz, New York, N.Y. (1963)

Editorial Committee, 26th Yearbook (Evaluation)

Donovan A. Johnson, Minneapolis, Minn., Chairman
Robert Fouch, Chicago, Ill.
E. Glenadine Gibb, Cedar Falls, Iowa
Max Sobel, Fair Lawn, N.J.
Ben A. Sueltz, Cortland, N.Y.
J. Fred Weaver, Boston, Mass.

Editorial Committee, 27th Yearbook (Talented)

Julius Hlavaty, New York, N.Y., Chairman
Albert Blank, New York, N.Y.
Joseph L. Payne, Ann Arbor, Mich.
Richard Pieters, Andover, Mass.
Harry Ruderman, New York, N.Y.
Henry Syer, Kent, Conn.
Henry Van Engen, Madison, Wis.

Evaluation of Experimental Programs Committee

Philip Peak, Bloomington, Ind. (1962), Chairman
Alice M. Hach, Ann Arbor, Mich. (1961)
Kenneth B. Henderson, Urbana, Ill. (1963)
Z. L. Loflin, Lafayette, La. (1962)
Myron Rosskopf, New York, N.Y. (1963)

National Council Representatives

AAAS Co-operative Committee on Science and Mathematics

Bruce Meserve, Montclair, N.J. (1962)

Educational Advisory Committee to Science Service

Veryl Schult, Washington, D.C. (1962)
Helen Cooper, Bethesda, Md. (1961)

Conference Board of the Mathematical Sciences

Burton W. Jones, Boulder, Colo. (1961)
John R. Mayor, Washington, D.C. (1962)

U.S. Commission on Mathematics Instruction

Phillip S. Jones, Ann Arbor, Mich. (1961)

E. H. C. Hildebrandt, Evanston, Ill. (1963)

AAAS Council

James Zant, Stillwater, Oklahoma (1962)

Veryl Schult, Washington, D.C. (1961)

Committee on Co-operation in Teacher Education

Veryl Schult, Washington, D.C.

TEPS Meeting

Clifford Bell, Los Angeles, Calif.
M. Vere DeVault, Austin, Texas
Alice M. Hach, Ann Arbor, Mich.
William Matson, Seattle, Wash.
C. Richard Purdy, Hayward, Calif.
Henry Syer, Kent, Conn.

NEA Delegate Assembly

Irvin Brune, Cedar Falls, Iowa

Meetings:

NEA, Joint Meeting, 1960, Los Angeles, Calif., June 29

Local Arrangements and Program Chairmen: Marian Cliffe Herrick, Clifford Bell

Summer, 1960, Salt Lake City, Utah

Local Arrangements Chairman: Eva Crangle, Salt Lake City

Program: Phillip S. Jones, Ann Arbor, Mich., Mildred B. Cole, Aurora, Ill.

Christmas, 1960, Tempe, Arizona

Local Arrangements Chairman: Lehi Smith, Tempe, Arizona

Program: Mildred B. Cole, Aurora, Ill.

Spring, 1961, Chicago, Ill., April 5

Local Arrangements Chairman: Hobart Sistler, Berwyn, Ill.

Program: Clifford Bell, Los Angeles, Calif., Mildred B. Cole, Aurora, Ill.

Summer, 1961, Toronto, Canada

Program: Clarence E. Hardgrove, DeKalb, Ill., Eunice Lewis, Norman, Okla.

Convention Previews

The Thirty-ninth Annual Meeting of the National Council of Teachers of Mathematics, to be held in the Conrad-Hilton Hotel, Chicago, Illinois, April 5–8, 1961, should be of special interest to elementary-school mathematics teachers.

Speaking at the second general session, Dr. Ben A. Sueltz has selected for the title of his address, "Mathematics in the Elementary School—a Time for Decision." A series of mathematics lectures for elementary teachers throughout the convention features the "Arithmetic Program of SMSG"; "Numbers, Sets, and Counting"; "Ways of Thinking About Space."

For those harassed with the problems of acceleration, there are two timely addresses at sectional meetings. In addition to these, there is a discussion group planned not only to consider problems of the gifted learner, but also the so-called slow learner and average learner. There are papers concerned with specific techniques in teaching arithmetic. Included among these are "Decimals and Per Cents," "Division by a Fraction," "New Aspects of Teaching Fractions," and "Fusing Arithmetic with Modern Mathematics." For the administrative staff of the elementary school, there is one section of particular in-

terest. Also, in-service programs for elementary teachers have not been neglected. There are the ever-popular laboratories featuring not only visual aids but a laboratory of ideas. And for those who like to see a teacher in action, there will be another demonstration class. Aspects of evaluation of mathematical learnings and attitudes of elementary-school children will also be examined.

Among those who will speak at sectional meetings are Morgan Ward, Truman Botts, Margaret Matchett, Arden Frandsen, Joseph Urbancek, Anita Riess, Helen Garstens, Julia Adkins, Jean Hamilton, W. T. Guy, Jr., George Janicki, Mrs. James Resh, Josephine Magnifico, George McMeen, Ramona Goldblatt, Richard Madden, and Joy Mahachek.

The business meeting comes early on the program. This meeting will be one of special significance to the members of the National Council of Teachers of Mathematics, for at this time proposed amendments to both the Bylaws and Articles of Incorporation will be presented.

Summer institutes in mathematics and science-mathematics for elementary-school personnel

The National Science Foundation has provided funds to support nineteen summer institutes in 1961 for elementary-school teachers, supervisors, and principals. Primary emphasis in the institutes will be devoted to strengthening the participants' knowledge of mathematics and science. Information and application blanks may be obtained only from the host institutions. The completed application blanks must be postmarked by March 15, 1961, to assure consideration.

Institutes in mathematics only or in mathematics and science are given here. Address correspondence to the person named with each institution.

Mathematics

University of Buffalo, 6 weeks, July 5–August 12: *Mathematics;* for teachers (grades 1–6), principals, and mathematics supervisors. Dr. Edith R. Schneckenburger, Dept. of Mathematics, University of Buffalo, Buffalo 14, N.Y.

University of Illinois, 8 weeks, June 19–August 12: *Mathematics;* for teachers (1–6). Prof. David A. Page, Dept. of Education, University of Illinois, Urbana, Ill.

Prairie View A. and M. College, 6 weeks, July 17–August 26: *Mathematics;* for teachers (1–6). Dr. Israel E. Glover, Dept. of Mathematics, Prairie View A. and M. College, Prairie View, Tex.

Rutgers—the State University, 6 weeks, July 2–August 11: *Mathematics;* for teachers (K–6) and supervisors. Dr. Robert L. Swain, Dept. of Mathematics, Rutgers—the State University, New Brunswick, N.J.

College of St. Catherine, 6 weeks, June 19–July 28: *Mathematics;* for teachers (5–6) and principals. Sister Seraphim, College of St. Catherine, St. Paul, Minn.

Southeastern State College, 4 weeks, August 7–September 1: *Mathematics;* for teachers (1–6) and supervisors. Dr. Leslie A. Dwight, Dept. of Mathematics, Southeastern State College, Durant, Okla.

University of Texas, 6 weeks, June 12–July 22: *Mathematics;* for teachers (1–6) and supervisors. Dr. W. T. Guy, Jr., Dept. of Mathematics, University of Texas, Austin 12, Tex.

Mathematics and science

Beloit College, 8 weeks, June 19–August 11: *Chemistry; Geology; Mathematics; Physics;* for teachers (1–6) and supervisors. Dr. John L. Biester, Dept. of Chemistry, Beloit College, Beloit, Wis.

DePauw University, 6 weeks, June 26–August 4: *General Science; Mathematics;* for teachers (5–6). Dr. Donald J. Cook, Dept. of Chemistry, DePauw University, Greencastle, Ind.

University of Oregon, 8 weeks, June 19–August 12: *Astronomy; Earth Sciences; Mathematics;* for teachers (1–6). Dr. Edwin E. Ebbighausen, Dept. of Physics, University of Oregon, Eugene, Ore.

San Fernando Valley State College, 6 weeks, June 19–July 28: *Chemistry; Geology and Astronomy; Mathematics; Physics;* for teachers (1–6), principals, and supervisors. Prof. Ruth L. Roche, Dept. of Education, San Fernando Valley State College, Northridge, Calif.